GTX FACILITY PROPERTY DESCRIPTION

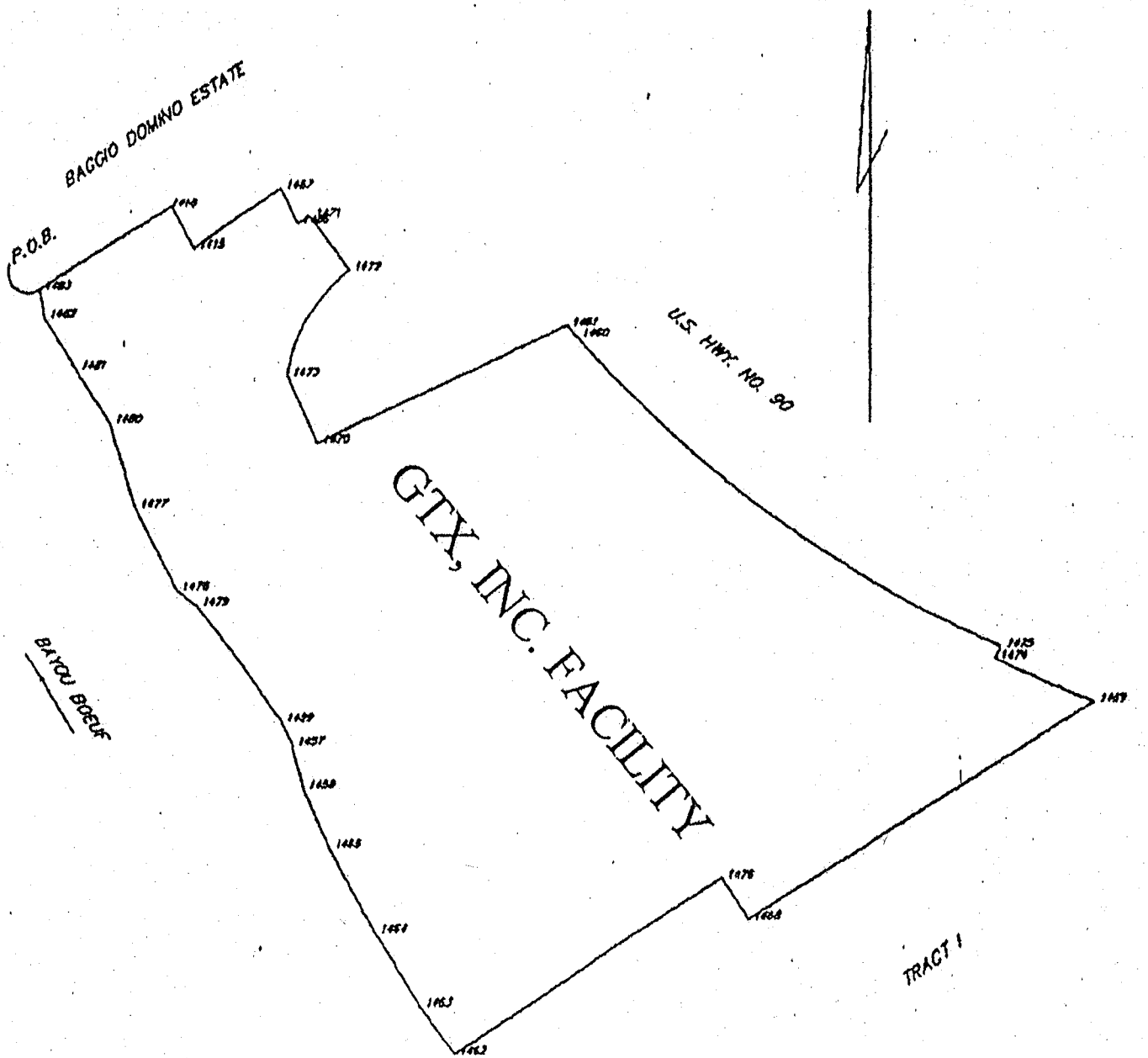
Located in Section 44, T16S-R13E
St. Mary Parish, Louisiana

Commencing on the property line common to the Estate of Biaggio Domino and the subject tract at the right descending bank of Bayou Boeuf. Said point being the POINT OF BEGINNING,

Thence N 58-09-48.0 E 364.996 Feet to a point,
Thence S 24-48-12.0 E 123.150 Feet to a point,
Thence N 55-57-57.1E 218.368 Feet to a point,
Thence S 26-06-39.9 E 87.405 Feet to a point,
Thence N 63-40-34.7 E 31.331 Feet to a point,
Thence S 36-06-56.7 E 149.558 Feet to a point,
Thence 281.943 Feet along a curve to the left having a radius of 362.330 Feet to a point,
Thence N 80-36-02.4 E 639.585 Feet to a point,
Thence S 40-41-36.5 E 32.854 Feet to a point,
Thence 1194.703 Feet along a curve to the left having a radius of 2944.926 Feet to a point,
Thence S 26-03-45.5 W 30.000 Feet to a point,
Thence 242.206 Feet along a curve to the left having a radius of 2974.926 Feet to a point,
Thence S 57-41-55.9 W 905.446 Feet to a point,
Thence N 32-18-04.1 W 111.682 Feet to a point,
Thence S 57-37-25.1 W 710.200 Feet to a point,
Thence N 36-11-32.1 W 133.775 Feet to a point,
Thence N 32-16-39.6 W 190.793 Feet to a point,
Thence N 28-49-35.4 W 218.344 Feet to a point,
Thence N 24-01-05.7 W 145.652 Feet to a point,
Thence N 14-07-49.9 W 101.710 Feet to a point,
Thence N 23-02-26.4 W 61.334 Feet to a point,
Thence N 34-45-36.5 W 329.876 Feet to a point,
Thence N 49-25-12.8 W 57.133 Feet to a point,
Thence N 25-22-16.2 W 211.633 Feet to a point,
Thence N 16-06-17.2 W 199.980 Feet to a point,
Thence N 31-51-51.3 W 145.655 Feet to a point,
Thence N 30-46-13.5 W 138.776 Feet to a point,
Thence N 10-34-57.5 W 78.072 Feet back to the POINT OF BEGINNING.

Said Tract contains an area of 2103434.76 Square Feet (48.2882 Acres)

FACILITY MAP


BAGGIO DOMINO ESTATE
P.O.B.
U.S. HWY. NO. 90
GTX, INC. FACILITY
BAYOU BOEUF
TRACT I

PROPERTY OWNED BY
MARINE SHALE PROCESSORS, INC.

IMMOVABLE PROPERTY

ALL THAT CERTAIN PIECE OR PORTION OF GROUND, together with all the buildings and improvements thereon, and all of the rights, ways, means, privileges, servitudes, prescriptions, appurtenances and advantages thereunto belonging or in anywise appertaining thereto, situated in the Parish of St. Mary, State of Louisiana, in Section 44, Township 16 South, Range 13 East, described in accordance with a survey by Robert E. Miller, Jr., dated November 12, 1984, copy of which is attached hereto and made part hereof, as follows, to-wit:

From the Northwest corner of Section 16, Township 16 South, Range 13 East, St. Mary Parish, Louisiana, go South 37 degrees 43 minutes 04 seconds East 10,257.19 feet to an iron situated at the northeast corner of the subject property and the point of intersection of the line dividing the property of Pelican State Lime, (a division of S I Lime Company) from the property of Domino Estates Partnership and the original survey line of property by T. F. Kramer, dated September 6, 1952, and the point of beginning.

From the point of beginning, go along the line dividing the property owned by Domino Estates Partnership from the property of S I Lime Company, South 58 degrees 31 minutes 59 seconds West 351 feet to a corner "C"; thence recommence at the point of beginning labeled corner "D" on the referenced plat and go along a line located within the 60 foot wide right of way South 24 degrees 28 minutes 01 seconds East 968 feet to corner "E"; thence go South 22 degrees 27 minutes 01 seconds East 200 feet to a corner "A" on the line dividing the property of S I Lime Company from the property of the Kurzweg-Miller family; thence leaving said right of way go along the line dividing the property of S I Lime Company from the property of the Kurzweg-Miller family South 61 degrees 42 minutes 59 seconds West 287 feet to a corner "B" located on the bank of Bayou Boeuf; thence go along the meanderings of Bayou Boeuf in a northerly direction 1105 feet, more or less, to corner "C" previously established, including all of vendor's right, title and interest in and to any and all accretions, alluvion, artificial fill or other projections of any kind or nature into Bayou Boeuf.

Vendor further transfers all of its right, title and interest in and to a certain servitude of use and permit granted by the Estate of Lucia R. Domino to Radcliff Materials, Inc., dated April 1, 1971, recorded in Conveyance Book 16-P, at folio 629 of the official records of St. Mary Parish, Louisiana.

Being the same property acquired by S I Lime Company, an Alabama Corporation, from Radcliff Materials, Inc., an Alabama Corporation, by deed under private act acknowledged in August, 1973, of record in Conveyance Book 17-W at folio 580 of the official records of St. Mary Parish, Louisiana.

PROPERTY OWNED BY
RECYCLING PARK, INC.

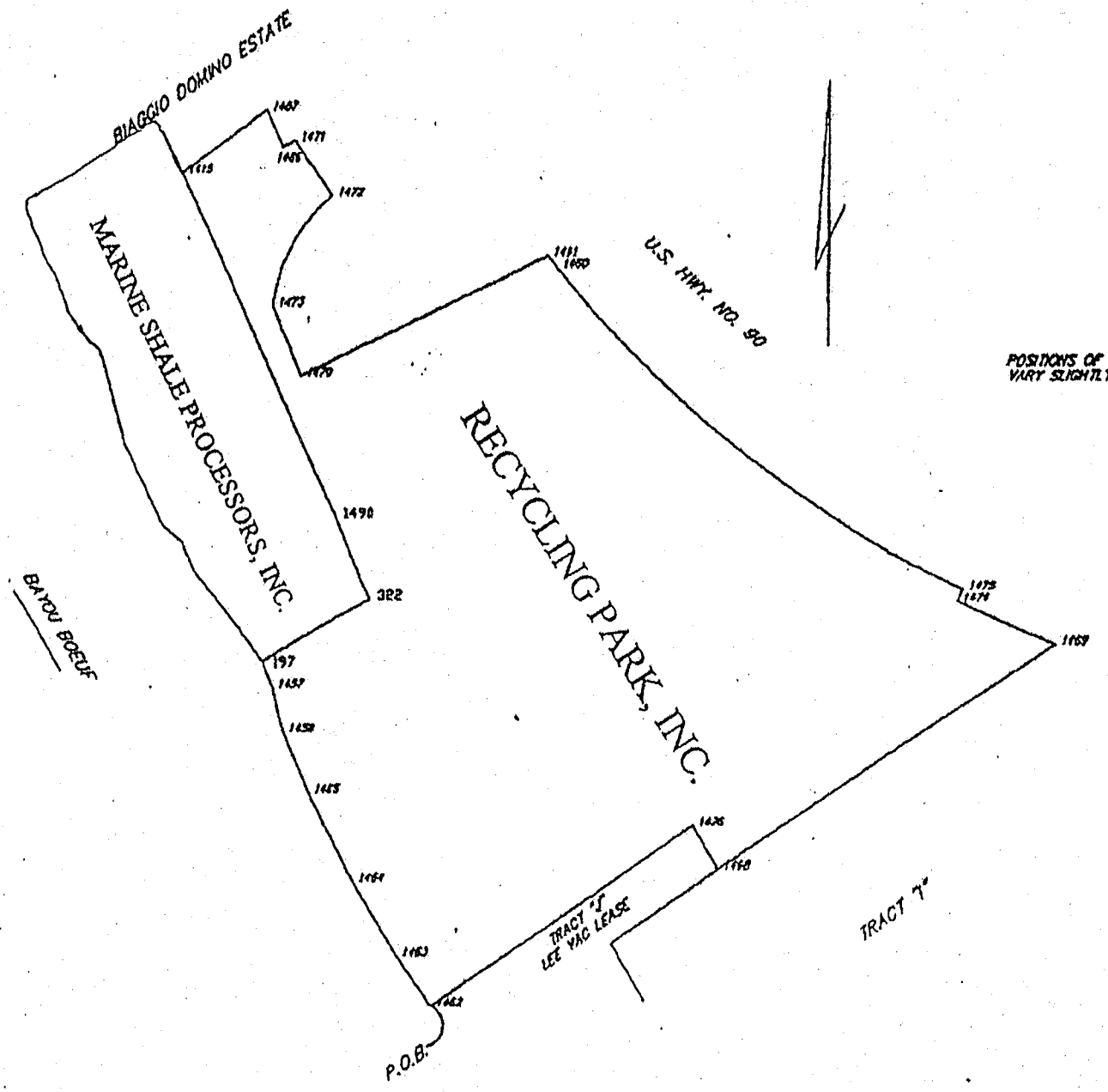
DESCRIPTION A 37.7174 ACRE TRACT
LOCATED IN SECTION 44, T16S-R13E
ST. MARY PARISH, LOUISIANA

Commencing on the line common to the Lee Vac, Inc. Lease (Tract "J") and the subject tract at the right descending bank of Bayou Boeuf. Said point being the POINT OF BEGINNING,

Thence N 36-11-32.1 W 133.775 Feet to a point,
Thence N 32-16-39.6 W 190.793 Feet to a point,
Thence N 28-49-35.4 W 218.344 Feet to a point,
Thence N 24-01-05.7 W 145.652 Feet to a point,
Thence N 14-07-49.9 W 101.710 Feet to a point,
Thence N 23-02-28.9 W 61.334 Feet to a point,
Thence N 61-17-27.6 E 281.398 Feet to a point,
Thence N 22-22-55.1 W 202.136 Feet to a point,
Thence N 24-19-12.9 W 844.854 Feet to a point,
Thence N 55-57-57.1 E 218.368 Feet to a point,
Thence S 26-06-39.9 E 87.405 Feet to a point,
Thence N 63-40-34.7 E 31.331 Feet to a point,
Thence S 36-06-56.7 E 149.558 Feet to a point,
Thence 281.943 Feet along a curve to the left having a radius of 362.330 Feet to a point,
Thence S 23-40-20.7 E 169.462 Feet to a point,
Thence N 65-14-21.1 E 619.954 Feet to a point,
Thence S 40-41-36.5 E 32.854 Feet to a point,
Thence 1194.703 Feet along a curve to the left having a radius of 2944.926 Feet to a point,
Thence S 26-03-45.5 W 30.000 Feet to a point,
Thence 242.206 Feet along a curve to the left having a radius of 2974.926 Feet to a point,
Thence S 57-41-55.9 W 905.446 Feet to a point,
Thence N 32-18-04.1 W 111.682 Feet to a point,
Thence S 57-37-25.1 W 710.200 Feet to the POINT OF BEGINNING.

Said Tract contains an area of 1642971.91 Square Feet (37.7174 Acres)

FACILITY PROPERTY OWNERSHIP MAP


BIAGGIO DOMINO ESTATE
MARINE SHALE PROCESSORS, INC.
RECYCLING PARK, INC.
U.S. HWY. NO. 90
BAYOU BOEUF
TRACT "J"
LEE VAC LEASE
TRACT "I"
P.O.B.
1467
1471
1468
1472
1473
1470
1491
1490
1498
322
197
1457
1458
1465
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POSITIONS OF SOME LINES ARE CACULATED ONLY AND MAY VARY SLIGHTLY IF ACTUALLY SURVEYED.

RPI FACILITY

Area A

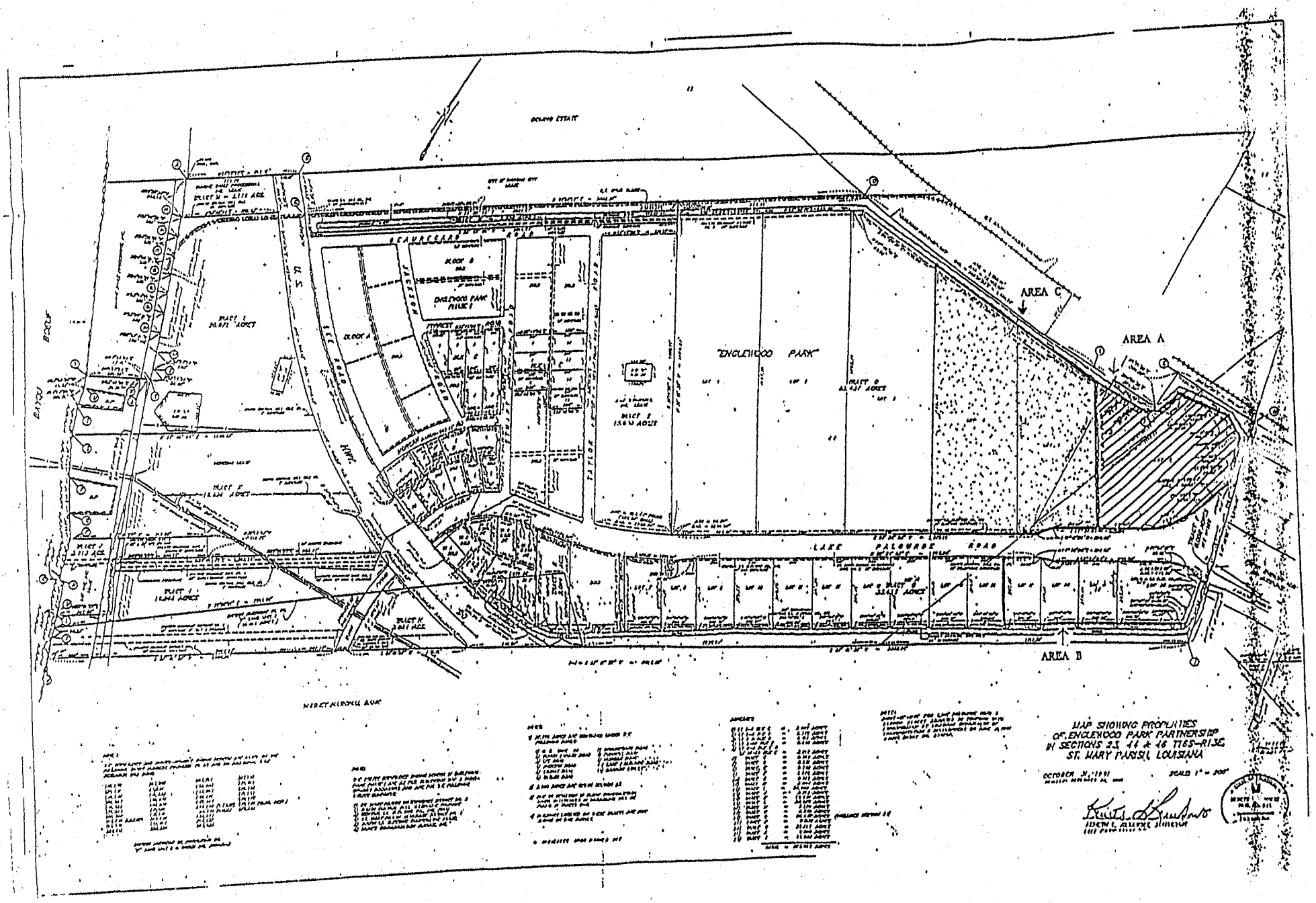
That area allocated in the tract of land designated at Tract O, Lot 6 on the attached map prepared by Keneth L. Rembert, Land Surveyor, dated October 31, 1991, Rev. December 31, 1991, and entitled Map Showing Properties of Englewood Partnership in Sections 23, 44, 46, T16S-R13E, St. Mary Parish, Louisiana.

Area B

That area located in the tract of land designated as Tract Q, Lots 16, 17, 18, 19, and 20 on the attached map prepared by Keneth L. Rembert, Land Surveyor, dated October 31, 1991, Rev. December 31, 1991, and entitled Map Showing Properties of Englewood Park Partnership in Sections 23, 44, and 46 T16S-R13E, St. Mary Parish, Louisiana.

Area C

That area located in tract of land designated as Tract O, Lots 4 and 5 on the attached map prepared by Keneth L. Rembert, Land Surveyor, dated October 31, 1991, Rev. December 31, 1991, and entitled Map Showing Properties of Englewood Park Partnership in Sections 23, 44, and 46 T16S-R13E, St. Mary Parish, Louisiana.


AREA C
AREA A
AREA B
"ENGLEWOOD PARK"
LAKE PALOURDE ROAD
MAP SHOWING PROPERTIES
OF ENGLEWOOD PARK PARTNERSHIP
IN SECTIONS 23, 44 & 46 T16S—R13E,
ST. MARY PARISH, LOUISIANA

APPENDIX C

WORK PLAN FOR IMPLEMENTATION OF THE
REMEDIAL MEASURES AT THE RPI FACILITY

The RPI Facility generally is divided into three areas which are identified as Areas A, B, and C. See Appendix B.

Within 90 days after the Effective Date of the Consent Decree or the satisfaction of the conditions set forth in Paragraph 21 of the Consent Decree, whichever occurs later, SWP shall commence the clearing and grubbing of Area A of the RPI Site. Within 24 months thereafter, SWP shall complete the Remedial Measures described herein for Area A of the RPI Facility. Area A generally consists of Unmixed SWP Disputed Material, which totals approximately 89,000 tons of Disputed Material. Previously, others have spread and leveled native soil of varying thickness (but having a minimum verified thickness of six inches) on Area A. However, a portion of Area A, located on the northwest side, was left with a steep slope. Because the follow-up work was never finished, the portion exists as an abrupt, steep face that is susceptible to sloughing and lateral movement. The entire Disputed Material area will be cleared and grubbed where required, which will allow the entire cap area to be exposed. Native soil or imported material will be placed along the northwestern edge of the Disputed Material to provide a 3H: 1V side slope. Additional cap material will be placed, leveled and compacted to provide a minimum two foot cap over the Disputed Material and a 4% slope from the center of the pile to the outside edges. Upon satisfactory testing of the cap material, an additional six inches of loose topsoil will be placed and spread over the entire Disputed Material area. This topsoil will then be seeded and fertilized to allow for reasonably expedient growth of grass. In addition, in Area A there is an HPDE liner that underlies and extends beyond the Disputed Material. The portion of the liner that extends beyond the Disputed Material is exposed to the

elements and as a result water has pooled on the liner. Therefore, that portion of the exposed HPDS liner shall be cut and removed from Area A or completely covered by the two foot cap described above.

Within 150 days after the Effective Date of the Consent Decree or the satisfaction of the conditions set forth in Paragraph 21 of the Consent Decree, whichever occurs later, SWP shall commence the clearing and grubbing of Area B of the RPI Site. Within 24 months thereafter, SWP shall complete the Remedial Measures described herein for Area B of the RPI Site. Area B of the RPI Site generally consists of Non-SWP Disputed Material. Previously, others have spread and leveled native soil of varying thickness (but having a minimum verified thickness of six inches) on Area B. This entire site has well sloped and stabilized edges and no fissuring or erosion is evident. The entire Disputed Material area will be cleared and grubbed where required, which will allow the entire cap area to be exposed. Additional cap material will be placed, leveled and compacted to provide a minimum two foot cap over the Disputed Material and a minimum two inches fall from the center of the pile to the outside edges. Upon satisfactory testing of the cap material an additional six inches of loose topsoil will be placed and spread over the entire Disputed Material area. This topsoil will then be seeded and fertilized to allow for expedient growth of grass.

Within 210 days after the Effective Date of the Consent Decree or the satisfaction of the conditions set forth in Paragraph 21 of the Consent Decree, whichever occurs later, SWP shall commence the clearing and grubbing of Area C of the RPI Site. Within 24 months thereafter, SWP shall complete the Remedial Measures described herein for Area C of the RPI Facility. Area C of the RPI Site generally consists of Mixed SWP Disputed Material, Non-SWP Disputed Material, and SWP Disputed Material. Previously, others placed a native soil of varying

thickness over the Disputed Material in Area C. The two largest piles in Area C are along the southwestern edge of the site and average fourteen feet above finished grade. The two smaller piles are southwest of Area A and average eight feet above natural grade. The area has become overgrown with vegetation and generally has slopes around 1.5H:IV. No previous efforts were made to spread, level, or grade the Disputed Material in Area C. Sloughing is evident around the larger piles with minor gullying evident on the smaller piles. The entire Disputed Material area will be cleared and grubbed where required, which will allow the entire cap area to be exposed. The four discrete piles will be combined into one large pile (similar to Area B) having an approximate nominal height of seven feet above grade. The material will be spread and turtle-backed to allow for positive flow off the top of the pile. A minimum two foot thick cap will be placed over the Disputed Material with a minimum two inches fall from the center of the pile to the outside edges.

Material to be utilized for cap material must have permeability less than lX10-7 cm/sec per ASTM 5084. Certain in-situ samples have been taken from native soil materials at a depth of 1-3 feet (composite samples) which show that this material meets this requirement. An area of 300 feet beyond the limits of the Disputed Material piles in Area C (and between all piles) may be excavated down to a depth of 36 inches. This material will be stockpiled on site and is expected to generate approximately 37,500 loose yards (27,750 cyns) of material meeting specifications. Imported material will be available from numerous local pits which generate a typical clayey/sand and clayey/silt material that should easily meet the permeability requirements. Cap material will be placed in maximum six inches compacted lifts and compacted to 90% standard proctor per ASTM D698 maintaining moisture at 2%-8% above optimum.

Upon satisfactory testing of the cap material to verify that it meets the requirements of Paragraph 22 of the Consent Decree, an additional six inches of loose topsoil will be placed and spread over the entire pile area. This topsoil will then be seeded and fertilized to allow for expedient growth of grass. Topsoil must consist of available material complying with LADOTD specifications. Generally, the material must have less than 20% organics, no rocks or cobbles larger than two inches, and minimal silt content. Topsoil must be well graded, free of lumps, and placed and spread while maintaining a compaction less than 85% standard proctor. Topsoil must be free of pesticides or other contaminants that will inhibit the growth of grass and vegetation.

The entire disturbed area will be seeded and fertilized. Seeding must be accomplished by spreading 45 pounds of Bermuda/rye grass per acre. Seed shall be broadcast or spread in two perpendicular passes to ensure adequate coverage. Immediately after seeding, the seed must be thoroughly watered and fertilized as appropriate to promote the growth of grass on the topsoil. All disturbed areas (piles, side slopes, on-site borrow areas, etc) must be watered and maintained until the site has been 85% established.

An accredited geo-technical testing services company must be retained to maintain a certified technician on site at all times during the Remedial Measures required in this Section, except for seeding, fertilizing, and watering. The on-site representative will observe all ongoing grading operations, assure compliance with the project specifications, and perform all testing of the in-place material, cap material (both native and imported), and will visit and approve borrow sources. Testing methods and frequencies shall comply with the following: (A) Permeability Testing - ASTM D5084, Required Value <lxl0-7cm/sec; testing Frequency-2tests/acre existing cap, 1 test per 6" Compacted Lift per acre for new Cap. Permeability also to be evaluated by on-

site testing representative using moisture (ASTM D-3017) and density (ASTM D-2922) relationships to predict in-place permeability; (B) Standard Proctor- ASTM D698, Testing Frequency 1 composite per off-site source, 1 per each on-site source; © Optimum Moisture- ASTM D3017, Required Value 2%-8% above optimum per ASTM D698 Testing Frequency 8 tests per acre per 6" compacted lift; and (D) Density - ASTM D2922, Required Value 90% optimum per ASTM D698Testing Frequency 8 tests per acre per 6" compacted lift.

Human Health Risk Assessment: Recycling Park, Inc. Facility

PREPARED FOR:
SOUTHERN WOOD PIEDMONT COMPANY
P.O. BOX 5447
SPARTANBURG, SC 29304

PREPARED BY:
CHEMRISK, INC.
25 JESSIE STREET
SUITE 1800
SAN FRANCISCO, CA 94105

DECEMBER, 2004

APPENDIX D

Executive Summary

Background

Several piles of material produced as a byproduct of the waste treatment operations conducted by Marine Shale Processors, Inc. (MSP) (Treated Material) have been placed at property owned by Recycling Park Inc. (RPI) located on Lake Palourde Road near Amelia, Louisiana (the Site). The Treated Material is located in three areas of the Site designated as Areas A, B, and C and is generally capped with approximately 2 ½ feet of native soil.

The Treated Material, as well as the native soil surrounding or underlying the Treated Material, the native soil cap material, surface water, groundwater, and sediments at the Site, was extensively sampled by Hydro-Environmental Technology, Inc. (HET) in February and March, 2004. The analytical results were reported in the Site Assessment Report (SAR) prepared by Hydro-Environmental Technology, Inc. dated July 19, 2004 (HET, 2004). HET concluded in the SAR that, based on the analytical results, the constituents of concern (COCs) at the Site are limited to the Treated Material itself.

The analytical results in the SAR were reported on a dry weight basis. The Louisiana Department of Environmental Quality (LDEQ) has determined, however, that the appropriate method of reporting analytical results for purposes of the LDEQ Risk Evaluation/Corrective Action Program (RECAP) is on a wet weight basis, rather than a dry weight basis (see the LDEQ website, RECAP Frequently Asked Questions, response to question 5 on the seventh page). Accordingly, the analytical results reported in the SAR (HET, 2004) have been converted to a wet weight basis using the formula prescribed by LDEQ. The analytical results calculated on a wet weight basis are provided in Appendix A to this HRA.

Notably, the conversion of the analytical results from a dry weight basis to a wet weight basis does not alter the conclusion in the SAR that the COCs are limited to the Treated Material itself.

ChemRisk, Inc., on behalf of Southern Wood Piedmont Company (SWP), conducted a human health risk assessment (HRA) of the chemical constituents in the Treated Material, the native soils surrounding or underlying the Treated Material, and the native soil cap material at the Site. This HRA quantitatively determined the potential human health risks should the Treated Material

be left in place. This HRA was conducted in accordance with the LDEQ RECAP guidelines. U.S. Environmental Protection Agency (EPA) guidance for conducting human health risk assessments was also used as supplemental guidance, as necessary. In accordance with RECAP, this HRA evaluates the analytical results reported on a wet weight basis (Appendix A). Further, in an effort to be consistent with RECAP's terminology, the term "soil", as hereafter used in this HRA, includes the Treated Material, the native soils surrounding or underlying the Treated Material, and the native soil cap material.

Analytical samples from the soil at the Site have been shown to contain various concentrations of metals. Based on the SAR (HET, 2004) and the RECAP screening process, the COCs and medium of concern were determined to be arsenic in Areas A, B, and C and lead in soil in Areas B and C.

Future use of the site is expected to be industrial, thus, potential risks from exposure to Site soils were evaluated for an industrial worker and a construction worker scenario (as potential exists for earth moving activities). Both noncarcinogenic and carcinogenic health risks were evaluated.

Noncarcinogenic health effects. Noncarcinogenic health effects are characterized using the "hazard quotient" approach. The "hazard quotient" or hazard index (HI) is the ratio between the agency-established acceptable or "safe" dose and the calculated dose associated with the Site. An HI of less than or equal to 1 indicates that the levels of exposure are acceptable even for chemicals having an additive effect. That is, an HI less than one indicates that the Site dose is less than the agency-established safe dose.

When individual COCs potentially act on the same organs or result in the same health endpoint (*e.g.*, respiratory irritant), hazard quotients for groups of chemicals are summed to derive the overall "hazard index." In this assessment, the HQ for each chemical, regardless of the target organ, has been summed. Evaluation of this additive effect is a very conservative approach which overestimates the true noncarcinogenic hazard.

Carcinogenic Health Effects. Carcinogenic health effects are defined in terms of the probability of an individual developing cancer as the result of exposure to a given chemical at a given

concentration. The incremental probability of developing cancer is the additional risk above and beyond the cancer risk an individual would face in the absence of the exposures characterized in this risk assessment. For example, a carcinogenic health risk of 1 x 10^{-5} means that the individual's risk of developing cancer is increased by 1 in 100,000 as a result of exposure to the chemicals at the site under the conditions (e.g. for the number of days per year at the Site, and the number of years at the Site, etc.) assumed in the risk assessment. Generally, risk within the range of 10^{-4} to 10^{-6} are considered acceptable by the U.S.EPA for Superfund sites (U.S.EPA, 1990) and are within the LDEQ requirements (LDEQ, 2003).

Evaluation of Lead Exposures. U.S.EPA has not verified noncarcinogenic or carcinogenic toxicity criteria (the reference dose or the slope factor, respectively) for lead. As a result, the noncarcinogenic health effects (e.g., a Hazard Index) and carcinogenic health risks (e.g., 1 x 10^{-5} cancer risk) of exposure to lead cannot be calculated. Instead, several modeling approaches have been developed to characterize blood lead levels associated with environmental and dietary exposures to lead. These models identify a target soil concentration based upon a target blood lead in terms of microgram of lead per deciliter of blood (µg/dL).

The U.S.EPA's methodology suggests a target blood lead concentration of 10 µg/dL. This method assumes that the exposed individual is a pregnant woman, and was designed to protect an unborn fetus, which is considered to be especially sensitive to the adverse health effects of lead. However, the OSHA blood lead concentration standard for women of child-bearing years is 30 µg/dL. Both target blood lead concentrations were used in this HRA to provide a measure of the upper and lower bound estimates of safe lead concentrations in soil that are protective of health.

Results

Human Health Risks. As stated, future use of the Site is expected to be industrial. Therefore, the potential risks from exposure to the chemical concentrations in Site soils were evaluated for an industrial worker and a construction worker scenario, assuming nearly unlimited direct contact by such workers with the Treated Material.

It is important to note that this HRA is not an assessment of the health risks posed by current Site conditions. At present, there is no direct exposure by workers or other persons to the Treated

Material and, thus, no risk. This is so because most if not all of the Treated Material is capped with approximately 2 ½ feet of native soil and, further, the Site is currently an inactive industrial facility, i.e. there are no industrial or construction workers at the Site. For these reasons, the assessment of the industrial and construction worker scenarios, assuming nearly unlimited direct exposure of such persons to the Treated Material, is considered to be hypothetical.

Nevertheless, this HRA demonstrates that, even under these hypothetical exposure scenarios, the Treated Material, if left in place, would not pose an unacceptable health risk to hypothetical industrial workers and construction workers at the site. The total noncarcinogenic hazard indices for both the construction worker and the industrial worker scenarios in each of the three areas of the Site are far less than 1, indicating a lack of noncarcinogenic hazard to these potential future workers. The theoretical increased cancer risk for the industrial worker who may be present in Area A is 5×10^{-6} (5 in 1,000,000) and 1×10^{-5} (1 in 100,000) for Areas B and C, and for the construction worker, the theoretical increased cancer risk is 3×10^{-6} (3 in 1,000,000) in Area A, and 6×10^{-6} (6 in 1,000,000) in Areas B and C. These theoretical risk levels are considered acceptable as they fall well within the tolerable cancer risk range of 1×10^{-4} and 1×10^{-6} (LDEQ, 2003; USEPA, 1990, 2001c).

The U.S. EPA Adult Lead Model was used to derive acceptable soil concentrations of lead for Areas B and C, the only two Treated Material areas that contained lead above the RECAP standard. Acceptable soil lead concentrations were developed using two target blood lead levels, 10 µg/dL and 30 µg/dL. As stated, the former is intended to be protective of the fetus of pregnant women and is a U.S.EPA guideline (U.S. EPA 1996b) while the latter is the OSHA limit for the general worker population (OSHA 29 CFR 1910.1025) and is protective of women of child bearing age. The results of this analysis are presented in the table below:

Exposure Scenario	10 µg/dL Target Blood Lead	30 µg/dL Target Blood Lead
Industrial Worker Scenario	1,980	9,490 mg/kg
Construction Worker Scenario	990	4,750 mg/kg

The 95 percentile upper confidence limit on the arithmetic mean (95% UCL) of lead in Area B is 3,715 and 2,223 in Area C. Thus, the lead concentrations present in Areas B and C are not expected to present an unacceptable health risk to future industrial and commercial workers at the Site as they fall within the range of safe soil concentrations as determined by this HRA using the U.S.EPA Adult Lead Model.

Risks Associated with Plausible Future Uses of the Site. The risks and acceptable soil lead concentrations in the hypothetical industrial and construction worker scenarios described above were calculated assuming nearly unlimited direct contact with the Treated Material for 25 years. As quantitatively determined in the Uncertainty Analysis of this HRA, the potential risk would be reduced to near *de minimis* levels (i.e., 1×10^{-6} for Area A; 3×10^{-6} for Area B; 2×10^{-6} for Area C) should direct contact with the Treated Material be limited to 50 days per year or less. Further, any potential risk associated with blood lead levels, even in a pregnant industrial or construction worker, would be removed by limiting exposure to 50 days per year or less as blood lead levels typically increase only as a result of long-term exposure to lead, i.e. exposure of at least 90 days (U.S. EPA 1996b).

Direct contact with the Treated Material may be limited to 50 days per year or less in a number of ways, including but not limited to the following (or any combination thereof):

- Maintaining a soil or clay cap over the Treated Material;
- Planting grass or other vegetation over the Treated Material;
- Paving over the Treated Material;
- Installing or constructing structures over the Treated Material; or
- The majority of worker activities are indoors or away from the Treated Material.

Should any of the foregoing uses of the Site be implemented, any health risk associated with leaving the Treated Material in place would thereby be greatly reduced or even eliminated.

To summarize, even assuming nearly unlimited direct contact with the Treated Material if left in place, the Treated Material would not pose an unacceptable health risk to potential future industrial and construction workers at the Site. Moreover, there are several plausible future uses of the Site (e.g., maintaining a soil or clay cap, planting grass or other vegetation, paving, construction of structures over the Treated Material, or worker activities away from Treated Material) any of which, if implemented, would limit direct contact with the Treated Material to less that that assumed by this HRA thereby greatly reducing or even eliminating any potential health risks.

As Site media pose neither a significant noncarcinogenic nor carcinogenic risk under potential future use scenarios, it should not be necessary to calculate cleanup standards using any of the RECAP Management Options.

1.0 INTRODUCTION

ChemRisk, Inc., on behalf of Southern Wood Piedmont, conducted a human health risk assessment (HRA) of the chemical constituents in soils and Treated Materials at the Recycling Park Inc. site in Amelia, Louisiana. Treated material samples have been shown to contain various concentrations of metals. The purpose of this HRA was to determine whether these chemical constituents, if left in place, would pose an unacceptable health risk to industrial users of the site.

The Louisiana Department of Environmental Quality's (LDEQ) Risk Evaluation/Corrective Action Program (RECAP) guidance was used to conduct this assessment. Specifically, this HRA was conducted in a manner consistent with RECAP Management Option 3 guidelines. U.S. Environmental Protection Agency (EPA) guidance for conducting human health risk assessments was also used as supplemental guidance, as necessary. Specifically, the following guidance documents were used:

- *Louisiana Department of Environmental Quality (LDEQ). 2003. Risk Evaluation/Corrective Action Program (RECAP). LDEQ Corrective Action Group. October 20, 2003.*
- *Risk Assessment Guidance for Superfund Volume I, Human Health Evaluation Manual (Part A).* 1989. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC. December. EPA/540/1-89/002.
- *Exposure Factors Handbook (EFH), Volumes I, II, and III.* 1997. U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC. February. EPA/600/P-95/002Fa.

1.1 SITE DESCRIPTION AND BACKGROUND

The Recycling Park, Inc. (RPI) facility is located on Lake Palourde Bypass in Amelia, St. Mary Parish, Louisiana (Figure 1) situated between United States Highways 90 and 182. The RPI facility is a commercial property owned by Recycling Park, Inc. No buildings or structures are located on the property; however, several piles of Treated Material exist in three (3) areas of the

site, designated as Areas A, B, and C. In addition, located on-site are a total of seven (7) monitoring wells that were originally installed between 1991 and 1999, and two (2) water outfall locations as designated by the U.S. EPA. The site is overgrown with grass vegetation and bushes, shrubs, and trees. The site property is bound on the north and east by a coulee, railroad tracks, undeveloped property, and United States Highway 90 East; on the south by undeveloped property; and on the west by undeveloped commercial property. Lake Palourde Bypass Road bisects the property on a southwest to northeast trend. Figure 2 contains a regional location map of the entire RPI property. Figure 3 contains a generalized site plan map of the site with regard to the stockpiles of Treated Material.

Portions of the RPI facility were developed on behalf of RPI for the purpose of storing Treated Material generated during MSP's processing operations at the Amelia, Louisiana plant. The MSP plant operated from approximately June of 1985 until June of 1996, at which time a potential sale of the facility to GTX was proposed. GTX secured the appropriate permits to operate the plant, but, thereafter, attempts to purchase and reopen the plant were abandoned.

Between 1992 and 1998, approximately 338,000 tons of Treated Material were transported to the RPI site and were separated into six (6) piles (Figure 3). Prior to placement of the Treated Material on the RPI property, the material was certified by MSP or designees to meet the applicable Environmental Protection Agency (EPA) Land Disposal Treatment Standards as defined under the Resource Conservation and Recovery Act (RCRA) in the Code of Federal Regulations Title 40 Chapter 1 Part 268.49.

Based upon information received from Mr. Mike Crocker, former employee of both MSP and Earthlock Technologies, L.L.C. (successor by merger of GTX, Inc.), it appears that approximately two and a half (2.5) feet of native soil was removed from land surface for the placement of a liner prior to introduction of Treated Material. In Area A of the RPI facility, a high density polyethylene (HDPE) liner was utilized, while the remaining Areas B and C were underlain with fabric liner. The excavated, native soils were placed on top of the Treated Material upon completion of stockpiling to serve as a cap. Typical heights of the stockpiles range from eight (8) feet above land surface in Areas A and B to approximately fourteen (14) feet above land surface in the western portion of Area C.

SWP understands that the Treated Material located in Area A of the site and the approximate 1,000-ton pile of Treated Material located in Area C of the site were generated from MSP's processing of contaminated soil received from SWP. SWP understands, however, that other Treated Material generated from SWP contaminated soils may have been mixed by MSP with Treated Material generated from non-SWP wastes and that this mixed Treated Material was then placed in Area C of the site.

The SWP soils processed by MSP were organically contaminated soils, typically containing creosote and pentachlorophenol constituents from SWP wood processing plants. From information received, the SWP soils were manifested as hazardous waste, because the soils were believed to have contained listed hazardous waste, specifically K001 and F032. Prior to the promulgation of the F032 waste code, some of the contaminated soils that contained similar types of waste were manifested as "K001-like" material. The contaminants of interest associated with these waste codes consist of volatile and semi-volatile organics and two (2) metals, arsenic and chromium. The SWP soils prior to processing may have also contained trace amounts of other RCRA metals. It is generally undisputed that all organic constituents that were present in the material sent by SWP to MSP were destroyed in MSP's process.

The 41,806 and 50,694 ton piles located in Area C and the 114,804 ton pile located in Area B of the site contain Treated Material from various generators. The 42,196 ton pile of Treated Material in Area C was generated from material previously sold by MSP to various people in the community prior to 1992.

1.2 REPORT ORGANIZATION

The remainder of this report is organized as follows:

Section 2.0 Hazard Identification – The process for the identification of the chemicals and media of concern is presented in this section.

Section 3.0 Dose-Response Assessment – The Agency-verified toxicity criteria for use in the quantification of potential human health risks are presented in this section.

Section 4.0 Exposure Assessment – This section presents the quantitative methodology for assessing potential contact with soils at the RPI site.

Section 5.0 Risk Characterization – Aspects of the Dose-Response Assessment are combined with the Exposure Assessment to quantitatively estimate potential health risks. Further, a qualitative uncertainty analysis is provided.

Section 6.0 Conclusions – A summary of the results of the HRA is provided in this section.

Section 7.0 References – All documents cited in this report are listed in this section.

2.0. HAZARD IDENTIFICATION

The hazard identification section outlines the screening methodology used to identify the Constituents of Concern (COCs) for the site and the media in which they are found. The initial screening processes were conducted in the SAR (HET, 2004) and Human Health Risk Assessment Work Plan (ChemRisk, Inc. 2004), both of which are reiterated below. It is important to note that in the SAR report (HET 2004) and the Risk Assessment Work Plan (ChemRisk 2004), the solid media were reported on a dry weight basis. In addition, all screening conducted in these two documents were conducted using the dry weight data. Consistent with RECAP guidance, the solid media results were converted to a wet weight basis. It is the results of this conversion to wet weight that are used in this HRA and presented in Appendix A.

Results of the Site Assessment Report Sampling and Screening Process

TCL Organics: In light of the known effectiveness of MSP's process for destroying organics, not all Treated Material samples were submitted for the analysis of Target Compound List (TCL) organics. All laboratory analytical results report TCL organic concentrations below the LDEQ RECAP screening standards.

TAL Metals: All Treated Material samples were analyzed for target analyte list (TAL) metals. There is no applicable RECAP screening standard for three of the 25 TAL metals (calcium, potassium, and sodium). For ten other metals (aluminum, beryllium, cobalt, hexavalent chromium, selenium, silver, thallium, vanadium, mercury, and total cyanide), none of the 69 Treated Material samples contained concentrations above RECAP screening standards. Consistent with RECAP standards, the results are reported on a wet weight basis and are included here as Appendix A.

The highest concentrations (on a wet weight basis) detected for the remaining 12 TAL metals above RECAP screening standards before taking into account SPLP results in each area of the site are as follows: antimony concentrations of 82 milligrams per kilogram (mg/kg) (Area A), 349 mg/kg (Area B), and 218 mg/kg (Area C); arsenic concentrations of 66 mg/kg (Area C), 115 mg/kg (Area B, and 150 mg/kg (Area C); barium concentrations of 12,920 mg/kg (Area A), 9,216 mg/kg (Area B), and 14,880 mg/kg (Area C); cadmium concentrations of 28 mg/kg (Area

A), 276 mg/kg (Area B), and 106 mg/kg (Area C); total chromium concentrations of 205 mg/kg (Area A), 1,248 mg/kg (Area B), and 828 mg/kg (Area C); copper concentrations of 21,160 mg/kg (Area B) and 4,368 mg/kg (Area C); iron concentrations of 27,720 mg/kg (Area A), 86,400 mg/kg (Area B), and 76,440 mg/kg (Area C); lead concentrations of 1,246 mg/kg (Area A), 6,048 mg/kg (Area B), and 7,990 mg/kg (Area C); magnesium concentrations of 12,960 mg/kg (Area A), 16,530 mg/kg (Area B), and 18,400 mg/kg (Area C); manganese concentrations of 682 mg/kg (Area A), 1,440 mg/kg (Area B), and 1,764 mg/kg (Area C); a nickel concentration of 2,668 mg/kg (Area A); and zinc concentrations of 15,980 mg/kg (Area B), and 17,640 mg/kg (Area C).

TCLP and SPLP: Selected Treated Material samples were analyzed for toxicity characteristic leachate procedure (TCLP) and/or synthetic precipitate leachate procedure (SPLP). Four (magnesium, manganese, nickel, and zinc) of the above 12 TAL metals that were detected above RECAP screening standards can be eliminated from further consideration under a risk assessment based on SPLP results, which indicate that these constituents do not pose a threat via the soil to groundwater pathway, thus eliminating the soil protective of groundwater screening standard for these constituents.

Results of the Human Health Risk Assessment Work Plan Screening Process

The screening process, or COC selection process, includes two main elements: 1) a summary of the relevant environmental data (i.e., calculation of summary statistics), including the determination of exposure point concentrations, and 2) determination of those chemicals that exceed the screening criteria. The purpose of the screening process is to identify those chemicals that are present in such small concentrations that they are not worthy of evaluation in the risk assessment. Chemicals presented in the Site Assessment Report (SAR; HET, 2004) were compared to the LDEQ Screening Option criteria (SOs), taking into account the synthetic precipitation leaching potential (SPLP) test results, and background tolerances. Those chemicals that exceed the SOs are further screened in this section of the HRA.

It is important to note that the SAR (HET, 2004) separately addressed the Treated Material, the native soils surrounding or underlying the Treated Material, and the native soil cap material, as well as sediments, surface water, and groundwater. The terminology used in RECAP for solid

media does not distinguish between the contamination and the environmental media (e.g., soil) in which it is found. In an effort to be consistent with RECAP's terminology, the term "soil", as used in this HRA, includes the Treated Material, the native soils surrounding or underlying the Treated Material, and the native soil cap material.

Appendix G of the SAR and Appendix A of this HRA present the analytical data for the soil, groundwater, sediment and surface water (HET, 2004). These tables show that the detected concentrations of chemical constituents in sediment, surface water, and groundwater were either below RECAP SO values or within background tolerances. However, there were several chemical constituents detected in the soil that were either present at concentrations greater than RECAP SO values or background tolerances. Antimony, arsenic, barium, cadmium, total chromium, copper, iron, lead, magnesium, manganese, nickel, zinc had maximum concentrations in the soil greater than the SO screening values. The SAR (HET, 2004) determined that magnesium, manganese, nickel, and zinc may be further eliminated based upon the results of the SPLP test, as they do not present a leaching hazard from soil to groundwater. The soil sample results are included in this HRA as Appendix A. Only those chemicals not eliminated in the SAR report (HET, 2004) included in this HRA and are subjected to the screening process described below. Details of the screening process are discussed below.

For the soil evaluation, COCs were determined for each of the three Areas of Concern (AOCs). These three AOCs have been previously defined as Areas A, B and C in the SAR (HET, 2004) and were discussed in Section 1.1 of this HRA. The soil samples were collected at depths ranging from 0 – 1 and 14 – 16 feet, with the exceptions of two samples in Area C that were collected at depths between 20 and 22 feet below land surface (bls) (TCB#22, 20-22 and TCB#22, 22-24). Consistent with RECAP guidelines, surface soil is considered to be at depths between 0 – 15 feet, thus all samples were considered to be surface soil samples. Despite the fact that samples TCB#22, 20-22 and TCB#22, 22-24 were collected below a depth of 15 feet, they were addressed as surface soil as a conservative, health protective measure.

Summary Statistics

Summary statistic calculations were performed for each chemical constituent not eliminated in the SAR report (HET, 2004) and include the following:

- Distribution type (i.e., normal, lognormal or neither)
- Number of samples, minimum, maximum, arithmetic mean
- 95% upper confidence limit (95% UCL)

Summary statistics were calculated using one-half of the limit of detection for all non-detected samples while duplicate samples were averaged. The distribution type for each data set (e.g. normal, lognormal, or neither) was used to determine the process for calculating the 95% UCL of the mean for each dataset, or the value that equals or exceeds the true mean of the dataset 95% of the time (95% UCL). Calculation of the 95% UCL followed the U.S.EPA guidance document "Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites," OSWER Directive 9285.6-10, December 2002 (U.S.EPA, 2002a). The Las Vegas Technical Support Center of the U.S.EPA has developed the software package ProUCL Version 3.00.02 to perform the calculation of UCLs (U.S.EPA, 2004a). Further, this software package has recently been incorporated into the OSWER guidance document (U.S.EPA, 2002a). The software used to calculate the 95% UCLs was previously described in the Human Health Risk Assessment Work Plan (ChemRisk, 2004). Documentation for the calculation for the 95% UCL (and other summary statistics) is provided in Appendix B. This appendix includes calculations for all metals present in soil, although not all metals in soil were of interest as they were eliminated in the SAR.

Screening Process

Chemical constituents not eliminated in the SAR report (HET, 2004) were further screened in this HRA using the Management Option 1 (MO-1) criteria as discussed below and the wet weight revision to the analytical data. As all other chemicals in other media have been eliminated from further consideration, the screening process in this HRA is limited to soil. In summary, chemicals present in Site media were considered potential COCs if they are not essential nutrients (i.e., calcium, potassium, and sodium), if they are present at levels in excess of naturally occurring background concentrations, and if their 95% UCL concentrations exceed the RECAP MO-1.

Health-Based Screening Criteria – As presented previously, a 95% UCL was calculated for each chemical in Areas A, B and C that was not eliminated in the SAR report (HET, 2004). These chemical-specific 95% UCLs were then compared to the appropriate RECAP MO-1 criteria. The MO-1 criteria were developed by LDEQ using conservative exposure assumptions and target risk levels for the purpose of screening multiple chemicals present in various media at a site. Based on the anticipated future land use of the site and direction from LDEQ, the industrial MO-1 values were used for soil screening purposes.

Tables 1 through 3 present the comparison of the 95% UCL concentrations to the MO-1 screening criteria. Based on this screening process and the SAR, a summary of the chemicals considered to be COCs for this HRA is provided below. It should be noted that the Risk Assessment Work Plan stated that benzo(a)pyrene would be addressed as a COC in this HRA. However, due to the use of wet weight analytical data, this chemical is no longer a COC as its maximum detected concentration (0.328 mg/kg) is less than the RECAP Screening Standard of 0.33 mg/kg). These chemicals will be further evaluated in this HRA.

Media	Area A	Area B	Area C
Soil	Arsenic	Arsenic Lead	Arsenic Lead
Groundwater	None	None	None
Sediment	None	None	None
Surface Water	None	None	None

3.0 DOSE-RESPONSE ASSESSMENT

Dose-response assessment is the process of characterizing the relationship between the dose of a chemical and the frequency of an adverse health effect in an exposed population (U.S.EPA, 1989). The dose is the quantity of the chemical that enters the body through all routes of exposure. The manner in which the dose-response relationship for a given chemical is quantitatively evaluated depends upon the nature of the adverse health effect. For example, the risks associated with very low doses of carcinogens are predicted using models; whereas, for noncarcinogenic effects, uncertainty factors are used to estimate a dose which is safe for even sensitive human subpopulations.

The body of knowledge about the dose-response relationship is based on data collected from animal studies and theoretical precepts about what might occur in humans. The U.S.EPA maintains an on-line database called the *Integrated Risk Information System* (IRIS; http://www.epa.gov/iriswebp/iris/index.html) which provides toxicity criteria for chronic oral and inhalation exposures based upon these studies. All data contained in IRIS are verified by a U.S.EPA work group, approved by each office of the U.S.EPA, and are updated monthly. As such, IRIS served as the primary source of toxicity values for this HRA.

The dose-response relationship is often established under controlled conditions (e.g., in the laboratory using test animals) in order to minimize responses due to confounding variables. Mathematical models are used to extrapolate the relatively high doses administered to animals to predict potential human responses at environmental contaminant levels that are typically far below those tested in animals. Such low doses may be "detoxified" or rendered inactive by the myriad of protective mechanisms that are present in humans (Ames et al., 1987). Consequently, the results of standard animal bioassays are of limited use in accurately predicting a dose-response relationship in humans at typical concentrations found in the environment. Risk assessment procedures acknowledge that the human population is likely to have a wider range of responses to toxic agents than the small groups of well-controlled, genetically homogenous animals used in exposure studies. Hence, the U.S.EPA attempts to correct for this factor, and others as discussed in the following section, through the use of uncertainty or safety factors in their toxicity criteria.

3.1 CHRONIC NONCARCINOGENIC HEALTH EFFECTS

In experimental systems such as animal bioassays, the benchmark against which allowable levels of exposure are calculated is the no observed adverse effect level (NOAEL). It is widely accepted that most biological effects of chemicals occur only after a threshold dose is exceeded (Klaassen *et al.*, 1986; Paustenbach, 1989a). For the purposes of establishing noncarcinogenic health criteria, this threshold dose is usually estimated from the NOAEL or LOAEL identified in chronic animal or human studies. The NOAEL is defined as the highest dose at which no adverse effects appear, while the LOAEL is the lowest dose at which adverse effects begin to appear (Klaassen *et al.*, 1986). The LOAEL or NOAEL from the most sensitive animal or human study is used by the U.S.EPA to establish long-term health criteria, which are called reference doses (RfDs) for exposures via the oral route and reference concentrations (RfCs) for exposures to chemicals via inhalation. The RfD is a daily intake level (mg/kg-day) of the chemical of interest for the human population, including sensitive subpopulations, that is not expected to cause adverse health effects over a lifetime of exposure (U.S.EPA, 1989).

In an attempt to account for limitations in the quality or quantity of available toxicological data, uncertainty factors are used with NOAELs (or LOAELs) to set RfDs for noncarcinogenic effects. Generally, an experimental NOAEL is divided by an uncertainty factor ranging from 10 to 10,000. A factor of 10 is used to account for uncertainties in extrapolating animal data to human health effects; another 10-fold factor accounts for differences in sensitivity within the human population; a third 10-fold factor is used if the available data base is incomplete and a fourth 10-fold factor is used if the exposures were for a partial lifetime (*i.e.*, sub-chronic). In cases where the data do not meet all the conditions for one of these categories and appear to fall between requirements for two categories, an intermediate uncertainty factor (usually 3) is used. It should be noted that RfDs are generally very conservative (*i.e.*, health protective) due to the repeated use of relatively large uncertainty (safety) factors.

The RfDs for the noncarcinogenic effects of the COCs are presented in Table 4. U.S.EPA has not verified noncarcinogenic or carcinogenic toxicity criteria (RfD or slope factor, respectively) for lead. Therefore, blood lead concentration modeling, as discussed in Section 4.5, using U.S.EPA's adult blood lead model (U.S.EPA, 1996b) for lead was used to assess its hazard.

3.2 CARCINOGENIC HEALTH EFFECTS

The historical regulatory approach has generally assumed that carcinogenic chemicals should be treated as if they have no dose below which a risk will not exist (e.g., there is no threshold) (Paustenbach, 1989b). In other words, it is assumed that any dose of a carcinogen, no matter how small, is assumed to present a cancer risk. This is a regulatory assumption. To estimate theoretically plausible responses at low doses, various mathematical models that describe the expected quantitative relationship between risk and dose can be used (Paustenbach, 1989a,b). While most models may fit the dose-response relationship adequately at high exposure levels used in animal studies, their ability to accurately predict responses at low doses may vary significantly (Paustenbach, 1989a). The accuracy of the projected risk depends on how well the model predicts the true relationship between dose and risk at dose levels where the relationship cannot actually be measured.

The mathematical model currently used by the U.S.EPA for low-dose extrapolation is the linearized multistage model (LMS). This model is based on the multistage theory of the carcinogenic process, which attempts to account for the fact that, in many types of cancer, the logarithm of the cancer mortality rate increases in direct proportion to the logarithm of age (Crump et al, 1976). This suggests that a cell may go through a sequence of specific changes (stages) before reaching a malignant state. The LMS model is used in U.S.EPA carcinogen assessments to estimate the dose-response characteristics of carcinogens at low exposure levels typically encountered in the environment. Health risks for exposures to carcinogens are defined in terms of probabilities. These probabilities identify the theoretical risk of a carcinogenic response in an individual that receives a given dose of a particular compound. The slope factor (SF), expressed in units of $(mg/kg\text{-}day)^{-1}$, multiplied by the daily human dose of the chemical, provides an estimate of the theoretical cancer risk.

The U.S.EPA classifies compounds, according to their weight-of-evidence for carcinogenic toxicity, into the following six groups (U.S.EPA, 1996a):

Group A	Human Carcinogen (sufficient evidence of carcinogenicity in humans)
Group B1	Probable Human Carcinogen (limited evidence of carcinogenicity in humans)
Group B2	Probable Human Carcinogen (sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans)
Group C	Possible Human Carcinogen (limited evidence of carcinogenicity in animals or lack of human data)
Group D	Not Classifiable as to Human Carcinogenicity (Inadequate or no evidence)

It is notable that EPA has proposed new cancer classification guidelines in 1999, however, these guidelines have not yet been incorporated into the IRIS framework.

Arsenic is classified as a Group A carcinogen and has verified oral and inhalation SFs by the U.S.EPA, both of which are presented in Table 4. Lead is classified as a B2 probable carcinogen, however, U.S.EPA has not developed toxicity criteria (RfDs or slope factors) for lead, and as a consequence, blood lead concentration modeling, as discussed in Section 4.5, was conducted using U.S.EPA's Adult Blood Lead model (U.S.EPA, 1996b). This blood lead modeling is based upon potential neurological effects as the Agency has concluded that the renal carcinogenic effects of lead are observed at dosages significantly higher than the doses that result in neurological effects.

4.0 EXPOSURE ASSESSMENT

Exposure assessment is the process through which the exposure of biological receptors to substances present in the environment is estimated and/or measured. Exposure assessment generally involves analysis of the following variables: 1) magnitude, duration and route of exposure; 2) nature and size of potential receptor populations; and 3) uncertainties associated with each variable (NAS, 1983).

Exposure pathways are determined by environmental conditions (*e.g.*, location of surface waters, groundwater, vegetative cover, and prevailing wind direction), by the potential for chemical migration from one environmental medium (*e.g.*, soil, water, or air) to another, and by the general activities of the potentially exposed populations (*e.g.*, time spent inside or outside, level of work activity). Each pathway describes a unique mechanism by which a population or an individual may be exposed to a chemical. Although several potential pathways may exist, not all are usually complete. For a pathway to be complete, the following conditions must exist:

- a source and mechanism of chemical release to the environment;
- an environmental transport medium (*e.g.*, air, water, soil);
- a point of potential human contact with the medium; and
- a human exposure route at the contact point (*e.g.*, inhalation, ingestion, dermal contact).

The potential for the occurrence of an adverse health effect associated with exposure to a chemical depends on the degree of systemic uptake (amount absorbed into the blood and tissues). For any route of exposure, the uptake (U) is the product of exposure (E) and the absorption (B):

$$U = E \times B$$

Where:

U = Uptake

E = Exposure

B = Bioavailability or absorption efficiency

Although a number of different factors are used to quantify exposure, the mathematical relationship shown above holds true for all exposure routes and is typically expressed as mass of chemical per mass of body weight per day (mg/kg-day).

4.1 IDENTIFICATION OF POTENTIALLY EXPOSED POPULATIONS

Currently, the site is an inactive industrial facility and the expected, continued future use of the site is industrial. Consequently, the potential exists for on-site workers to be exposed to the COCs. Therefore, it was the intent of this HRA to evaluate the potential human health impacts to future on-site workers. For this industrial exposure scenario, only adult exposure was quantified, as children are not generally present at an operating industrial facility. In addition, site expansion may occur in the future; therefore, a construction worker was also addressed in this HRA.

4.2 EXPOSURE SCENARIOS

Two occupational exposure scenarios were evaluated in this HRA; an industrial site worker who is conservatively assumed to spend the entire time at the facility outdoors and solely within each of the three AOCs, and a construction worker who is also assumed to spend the entire time within this exposure realm. Further, it was conservatively assumed that contact with the Treated Material was not precluded by the natural soil cap that is currently in place. This approach is highly conservative as it is unlikely that any site worker would spend their entire time at the facility within any of the three impacted AOCs or solely with the Treated Material. For these two exposure scenarios, the reasonable maximum exposure (RME) scenario was evaluated as described below.

Reasonable Maximum Exposure

The RME is representative of an upper-bound exposure and is an estimate of the highest exposure that is *reasonably* expected to occur at a site in a given population (U.S.EPA, 1989; 1992a). The RME is determined primarily by using upper bound estimates for key parameters, such as the 95th percentile estimates of exposure duration, and the median for other parameters (*i.e.*, body weight). These parameters are clearly defined in the LDEQ RECAP guidance for an industrial worker exposure scenario. However, LDEQ RECAP does not provide guidance on a construction worker scenario, thus U.S. EPA guidance and professional judgment was relied upon for this scenario.

4.3 Identification of Potential Exposure Pathways

Currently the COCs are present in the three Treated Material areas and are below a soil cap. This cap varies in thickness but is generally two and a half feet thick. Thus, the COCs are not readily available for direct contact pathways such as dermal contact or incidental soil ingestion. However, it may be possible for the subsurface soils which contain the COCs to, at some point, be brought to the surface by construction or other earth moving activities. To account for this possibility, for the industrial worker, this HRA quantifies exposure to the COCs in soils by assuming that they are present in surface soils and, thus available for dermal contact, incidental ingestion, and inhalation of particulates. As construction workers may conduct soil-intrusive activities, exposure of this population to soil below the cap is also quantified.

As presented in the HRA Work Plan, exposure to groundwater was considered to be an incomplete exposure pathway as it is not classified as a drinking water source. As such, this pathway was not addressed in this HRA (HET 2004).

4.4 Estimation of Exposure Point Concentrations

Reliable estimates of exposure point concentrations in soil are required to calculate the magnitude of exposure for humans. Therefore, representative soil concentrations were used in

this HRA to quantify exposure to the COCs. Consistent with LDEQ and U.S.EPA guidance for risk assessment (LDEQ 2003; U.S.EPA, 1989, 1992), representative site data were derived from the soil sampling data as discussed in Section 2.0 (i.e., 95% UCLs were utilized).

4.5 CONCEPTUAL SITE MODEL

The conceptual site model (CSM) for the site was developed by combining all elements of impacted media, transport mechanisms, exposure pathways, and potentially exposed populations (as discussed above). The CSM presented in the Human Health Risk Assessment Work Plan (ChemRisk, 2004) has been revised to reflect the complete exposure scenarios addressed by this HRA and is included as Figure 4.

4.6 EXPOSURE VIA INCIDENTAL INGESTION OF SOIL

For all on-site scenarios, the potential exists for individuals to ingest incidental amounts of impacted soil. The dose due to the soil ingestion pathway was quantified according to the following equation:

$$Dose = \frac{CS \times SIR \times CF \times EF \times ED \times OBF \times MET}{BW \times AT}$$

where:

Dose	=	Average daily dose (ADD) for noncarcinogens (mg/kg-day) or lifetime average daily dose (LADD) for carcinogens (mg/kg-day);
CS	=	95% UCL concentration of COC in soil (mg/kg);
SIR	=	Soil ingestion rate (mg/day);
CF	=	Conversion factor (10^{-6} kg/mg);
EF	=	Exposure frequency (days/year);
ED	=	Exposure duration (years);
OBF	=	Oral bioavailability factor (unitless)
MET	=	Meteorological factor (unitless)
BW	=	Body weight (kg); and

AT = Averaging time (days).

The exposure factors used to derive the estimated doses were obtained from the LDEQ RECAP and U.S.EPA risk assessment guidance documents (LDEQ, 2003; U.S. EPA 1989; 1997); they are presented in Table 5. When available, the exposure factors for the construction worker scenario were obtained from U.S. EPA guidance. For those which no guidance exists, professional judgment was used. Each of the exposure factors used for this pathway is discussed below.

Body Weight. The average body weight (BW) for an adult, 70 kilograms, will be used, as recommended in the RECAP and U.S.EPA guidance (LDEQ, 2003; U.S.EPA, 1989, 2001a,b).

Averaging Time. The averaging time is the time over which exposure occurs. For carcinogens, the averaging time (AT) is a 70 year lifetime (U.S.EPA, 2001a). For noncarcinogens, the AT is equal to the exposure duration; 25 years for the industrial worker and one year for the construction worker as discussed below.

Exposure Duration. The exposure duration (ED) is the number of years over which exposure occurs. The RECAP standard default exposure duration is 25 years and will be used for the industrial worker scenario.

Currently, neither the LDEQ nor U.S.EPA has any guidance on exposure duration for a construction worker. However, it is a reasonable assumption that soil intrusive activities for a site of this size would not occur for more than one year. Thus, an exposure duration of one year was used in this HRA for the construction worker scenario.

Exposure Frequency. The exposure frequency (EF) is the number of days per year during which exposure occurs. For the industrial/commercial worker scenario, the RECAP standard default exposure frequency of 250 days per year will be used for both the industrial and construction worker scenarios.

Soil Ingestion Rate. The soil ingestion rate (SIR) represents the amount of soil that may be incidentally ingested during exposure activities. A soil ingestion rate of 50 mg/day will be used for the industrial worker scenario as it is the RECAP and U.S. EPA recommended value for adults (U.S.EPA, 1997; 2001a). In lieu of RECAP guidance on soil ingestion rates for construction workers, the U.S. EPA recommended rate for outdoor workers of 100 mg/day (U.S. EPA 1997) was use in this assessment.

Oral Bioavailability Factor. Oral bioavailability factors (OBFs) are chemical specific values that represent the fraction of a chemical that may be liberated from the soil matrix and subsequently available for absorption following incidental soil ingestion. Metals such as arsenic have reduced bioavailability due to the presence of secondary reaction products and insoluble soil or in this case, Treated Materials matrixes (Davis et al., 1992). Many *in vitro* and *in vivo* studies support this conclusion. Rodriguez et al. (1999) and Ruby et al. (1996, 1999) have reported bioavailability of less than 50% for various soil types, mining waste, and smelter waste. Further, Roberts et al. (2002) observed arsenic bioavailability of less than 25% using a primate model and arsenic impacted soils from an electrical substation, wood preservative, pesticide, and a cattle dip facilities. This latter study was supported by the Florida Department of Environmental Protection. Based upon this evidence and given that the Treated Material has been subjected to extremely high temperatures and did not leach to any appreciable degree in the toxicity characteristics leaching potential (TCLP) test and synthetic precipitation leaching procedure tests, inclusion of a factor to account for this reduced bioavailability is warranted. The upper bound value as reported in these studies, 50%, was used in this HRA to ensure that the leaching potential of arsenic was not underestimated.

Meteorological Factor. Meteorological conditions such as rain or frozen ground may preclude direct contact with soil and suppress the suspension of respirable particulates. Studies have found that soil ingestion rates decrease significantly during times of precipitation (van Wijnen et al., 1990). Further, Calabrese and Stanek (1992) found that, on average, only about one-third of indoor dust was derived from outdoor soil. These data indicate that it is appropriate to consider the effect of inclement weather on incidental soil ingestion, dermal contact and inhalation of particulates (U.S. EPA 2001b).

A meteorological factor (MET) that accounts for only days with precipitation greater than or equal to 0.01 inches per day was utilized in this HRA. This factor ignores the days per year when the ground is frozen or following significant precipitation events but there is no precipitation, and thus is believed to be conservative. A review of 30 years of daily precipitation data from Baton Rouge, Louisiana (the nearest city with precipitation data) collected from 1961 to 1990 (U.S. EPA 2004b) indicates that, on average, this amount of precipitation falls on 110 days per year. This number was adjusted to estimate the number of weekdays that precipitation falls by multiplying 110 days per year by 5 weekdays per week and then dividing that product by 7 days per week. This indicates that, on average, there is precipitation of 0.01 inches or more on 79 weekdays each year leaving 171 workdays (68%) on which there is no precipitation. This unitless fraction (0.68) was used in this HRA to account for these meteorological conditions.

4.7 EXPOSURE VIA DERMAL CONTACT WITH SOIL

For the potentially exposed on-site worker populations, the potential exists for contact via dermal contact with the COCs in soil. Dermal intake via skin for the COCs in on-site soils was calculated according to the following equation:

$$Dose = \frac{CS \times AF \times DAF \times SA \times CF \times EF \times ED \times MET}{BW \times AT}$$

where:

Dose	=	Average daily dose (ADD) for noncarcinogens (mg/kg-day) or lifetime average daily dose (LADD) for carcinogens (mg/kg-day);
CS	=	95% UCL concentration of COC in soil (mg/kg);
AF	=	Soil adherence factor (mg/cm^2);
DAF	=	Dermal absorption factor (unitless);
SA	=	Exposed skin surface area (cm^2);
CF	=	Conversion factor (10^{-6} kg/mg);
EF	=	Exposure frequency (days/year);
ED	=	Exposure duration (years);

MET	=	Meteorological factor (unitless)
BW	=	Body weight (kg); and
AT	=	Averaging time (days).

The exposure parameters for this pathway were obtained from the RECAP risk assessment guidance with the exception of the construction worker exposure duration of one year (as discussed previously). Those exposure parameters unique to this pathway and not discussed previously are presented below.

Skin Surface Area. An exposed skin surface area (SA) of 3,300 cm^2 will be used for the industrial and construction worker scenarios. This is representative of the exposed skin of the arms, hands and face. This is the value recommended in the RECAP guidance (LDEQ, 2003).

Adherence Factor. The adherence factor (AF) describes the amount of soil that adheres to the skin per unit of surface area. The RECAP recommended value of 0.2 mg/cm^2 will be used for the industrial and construction worker scenarios (LDEQ, 2003).

Dermal Absorption Factor. Dermal Absorption Factors (DAFs) are chemical specific values that represent the fraction of a chemical that is dermally available from the soil matrix. The DAF of 0.03 for arsenic as recommended in Appendix H of the RECAP guidance was used in this HRA.

4.8 EXPOSURE VIA PARTICULATE INHALATION

The inhalation of particulates was quantified according to the following equation for the on-site potentially exposed populations. These scenarios were evaluated to quantify the daily dose for the COCs in on-site soils according to the following equation:

$$Dose = \frac{CS \times IR \times EF \times ED \times MET}{BW \times AT \times PEF}$$

where:

Dose	=	Average daily dose (ADD) for noncarcinogens (mg/kg-day) or lifetime average daily dose (LADD) for carcinogens (mg/kg-day);
CS	=	95% UCL concentration of COC in soil (mg/kg);
IR	=	Inhalation rate (m^3/day);
EF	=	Exposure frequency (days/year);
ED	=	Exposure duration (days);
MET	=	Meteorological factor (unitless);
BW	=	Body weight (kg);
AT	=	Averaging time (days); and
PEF	=	Particulate emission factor (m^3/kg).

All of the parameters used in the quantification of this pathway and not discussed previously are presented below.

Inhalation Rate. The inhalation rate (IR) represents the volume of air that is respired on a daily basis. The RECAP recommended volume of 20 m^3/day was used in the assessment (LDEQ, 2003).

Particulate Emission Factor. The USEPA default particulate emission rate of 6.88 x 10^{-8} g/m^2-second from the supplemental Soil Screening Guidance and the air dispersion factor (Q/C) for a

10 acre site of 46.2 g/m^2-sec per kg/m^3 based on the RECAP guidance (LDEQ, 2003) were used to calculate a PEF of 6.72 x 10^8 m^3/kg for the industrial worker in this assessment (USEPA, 2002b). For the construction worker, the AP-42 emission factor (USEPA, 1995) for heavy construction work of 2,690 kg/ha-month (1.04 x 10^{-4} g/m^2-sec) was combined with the same air dispersion factor (Q/C) of 46.2 g/m^2-sec per kg/m^3 (LDEQ, 2003) to derive a PEF of 4.44 x 10^5 m^3/kg.

4.9 NONCANCER ASSESSMENT FOR LEAD

The U.S.EPA has not promulgated an RfD or SF for lead on which to base a risk assessment. However, several modeling approaches have been developed to characterize blood lead levels associated with environmental and dietary exposures to lead. A discussion of U.S.EPA's approach is provided. It should be noted that the model output is a target soil concentration rather than a blood lead level or estimate of risk contrary to the methodology used for the other COCs in this HRA.

The U.S.EPA's *Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil* (1996b) was followed in this HRA. This methodology was developed by the U.S.EPA Technical Review Workgroup for Lead to be protective of women of child-bearing age. Because the method is designed to protect an unborn fetus, which is considered to be especially sensitive to elevated lead exposures, the 95% UCL target blood lead concentration of 10 µg/dL was used (CDC, 1991; U.S.EPA, 1996b). However, the OSHA standard for women of child-bearing years is 30 µg/dL. Both target blood lead concentrations were used in this HRA to provide a measure of the upper and lower bound estimates of health protective soil (Treated Material) concentrations. The approach is generally consistent with that used to set remedial goals at the National Priority List (NPL) Gulch site in Region VIII.

The equations and exposure parameters suggested in the guidance and provided in the calculation spreadsheet from the U.S. EPA website including the geometric standard deviation of 1.8 (as recommended for homogeneous populations), were utilized in the calculation of a site-

specific soil criterion for lead for the industrial and construction worker scenarios. The calculation spreadsheets are provided in Appendix C. In addition, the site-specific meteorological factor (MET) was included in the calculation. The only pathway of exposure considered in the U.S.EPA guidance is soil ingestion because lead is not known to be absorbed dermally to a significant degree, and inhalation of soil particulates is usually not a significant pathway of exposure (U.S. EPA 1996b). The remaining default parameters provided in the U.S. EPA guidance were used in this evaluation. For the construction worker scenario, the lead model default soil ingestion rate was changed to 100 mg/day to be consistent with this HRA and other U.S. EPA guidance. For those parameters that are described by a range of suitable values, values were selected that are generally consistent with the characteristics of the potentially exposed population at the site (*i.e.*, women of child-bearing age of a heterogeneous urban population).

5.0 RISK CHARACTERIZATION

The risk characterization provides a quantitative and qualitative discussion of the health hazards posed by the COCs. Both noncarcinogenic and carcinogenic health effects are addressed. As discussed in Section 4.0, noncarcinogenic health effects are characterized by comparing estimated doses to the maximally "acceptable" doses, and carcinogenic health risks are characterized with respect to cancer risks that typically trigger regulatory concern.

5.1 NONCARCINOGENIC HEALTH EFFECTS

Noncancer hazards are typically characterized using the "hazard quotient" approach (U.S.EPA, 1989). The hazard quotient (HQ) is the ratio of the calculated average daily dose (ADD) to the maximally acceptable "safe" dose (*i.e.*, the U.S.EPA's reference dose, or RfD):

$$Hazard\ Quotient = \frac{ADD}{RfD}$$

An HQ less than 1 indicates that the average daily dose for a particular pathway is below the level associated with a toxic effect. The smaller the HQ, the lesser the probability of an adverse health hazard. When individual COCs potentially act on the same organs or result in the same health endpoint (*e.g.*, respiratory irritant), hazard quotients for groups of chemicals are summed to derive the overall "hazard index."

$$Hazard\ Index = \frac{ADD_1}{RfD_1} + \frac{ADD_2}{RfD_2} + \ldots + \frac{ADD_n}{RfD_n}$$

A hazard index (HI) of less than or equal to 1 indicates that the levels of exposure are acceptable for chemicals having an additive effect. If the total HI is greater than one using this approach, a more thorough evaluation should be performed.

In Table 6, the HIs for the construction and industrial worker scenarios were presented and include all pathways (ingestion, inhalation, and dermal contact). Arsenic was the only chemical in this HRA with noncarcinogenic toxicity criteria and was considered a COC in each of the three AOCs. For the industrial worker, the hazard indices in Areas A, B, and C are 0.06, 0.1, and 0.1, respectively. For the construction worker scenario, the hazard indices in Areas A, B, and C are 0.2, 0.3, and 0.3 respectively.

5.2 CARCINOGENIC HEALTH RISK

Carcinogenic health risks are defined in terms of the probability of an individual developing cancer as the result of exposure to a given chemical at a given concentration (U.S.EPA, 1989). The incremental probability of developing cancer (*i.e.*, the theoretical excess cancer risk) is the additional risk above and beyond the cancer risk an individual would face in the absence of the exposures characterized in this risk assessment. The theoretical excess cancer risk is based on the LADD and is calculated as follows:

$$Theoretical\ Risk = LADD \times SF$$

Where:

LADD = Lifetime average daily dose (mg/kg-day)

SF = Cancer slope factor $(mg/kg\text{-}day)^{-1}$

The LADDs were used with the U.S.EPA cancer slope factors (Section 3.2) as described above to calculate the theoretical increased in cancer risk associated with exposure to the COCs at the site (Table 6).

In this assessment, as shown in Table 6, the theoretical increased cancer risk posed by the carcinogenic COCs is 5 x 10^{-6} for the industrial worker in Area A and 1 x 10^{-5} in Areas B and C.. For the construction worker scenario, the theoretical increased cancer risk is 3 x 10^{-6} for Area A and 6 x 10^{-6} for Areas B and C. Since these risks are within than the levels considered acceptable by the U.S.EPA for Superfund sites (10^{-4} to 10^{-6}) (U.S.EPA, 1990) and the LDEQ requirements (LDEQ, 2003), they should be considered acceptable for this site.

5.3 LEAD EVALUATION

The site-specific lead concentrations for the RPI Inc. facility are presented below.

Exposure Scenario	10 µg/dL Target Blood Lead	30 µg/dL Target Blood Lead
Industrial Worker Scenario	1,980 mg/kg	9,490 mg/kg
Construction Worker Scenario	990 mg/kg	4,750 mg/kg

The construction worker scenario soil criterion is lower than the industrial worker because the model does not account for exposure duration. That is, the model is insensitive to the number of years over which exposure may occur. For example, it does not matter if the duration is 10 days or 10 years, as the model will yield the same result. However, this is not entirely accurate since lead is a chronic toxicant, and therefore repeated exposure would influence the level of lead contained in the body. Therefore, caution should be exercised when relying upon this model as for short term exposures such as for a construction worker scenario as it most accurate when addressing long-term, continuous exposures.

The 95% UCLs of the soil concentrations for Areas B and C, 3,715 and 2,223 mg/kg, respectively, fall within the calculated range of acceptable concentrations as calculated in this HRA.

5.4 SEMI-QUANTITATIVE UNCERTAINTY ANALYSIS

There are numerous sources of uncertainty inherent in the risk assessment process. Some level of uncertainty is introduced into the assessment each time an assumption is made. Many assumptions have valid and strong scientific bases while others are estimates usually represented by a range of values (and these often incorporate professional judgment). Where there is uncertainty regarding an assumption, a conservative estimate is often chosen to ensure that the assessment will be health-protective. The following presents a consideration of some of the uncertainties associated with the risk assessment according to each of the major components of the analysis (*i.e.*, site characterization, data evaluation, toxicity assessment, exposure assessment, and risk characterization). It is a semi-quantitative analysis as this section presents alternative risk estimates based upon the use of alternative values for key exposure assumptions.

The purpose of this section is to identify and discuss the uncertainties associated with the quantitative estimates of risk presented in this assessment. This discussion serves to place the risk estimates in this assessment into proper perspective by fully specifying the assumptions and uncertainties inherent in the assessment (U.S.EPA, 1989). The key variables and assumptions are identified that contribute most to the uncertainty.

5.4.1 Hazard Identification

Use of Nondetect Data - As recommended by U.S.EPA guidance (1989), non-detected concentrations of chemicals detected in site media were included in the calculation of the 95% UCL concentrations using one-half the detection limit (U.S.EPA, 1989b). It should be noted that in most cases a chemical present in site media at a concentration equal to half the detection limit would be detected at least qualitatively. As such, the concentration of the chemical could be estimated, receiving a "J" qualifier from the laboratory. For this reason, the use of one-half the detection limit for non-detect data is conservative since if the COC was present at a concentration of one-half of its detection limit, it would most likely be qualified by the laboratory. In extreme cases, this practice can result in the calculation of mean and 95% UCL concentrations that exceed the maximum concentration. Exposure point concentrations calculated in this manner most likely exceed actual exposures.

5.4.2 Dose-Response Assessment

Reference Doses - Toxicity information for many constituents is limited for humans, consequently, depending on the quality and extent of toxicity information, varying degrees of uncertainty will be associated with the calculated toxicity values. In general, the procedures used to extrapolate from animals to humans in toxicity studies include the use of uncertainty factors so that the potential hazard to humans is likely to be overestimated rather than underestimated. As discussed in Section 3.1, it is widely accepted in the scientific community that low doses of toxicants may be detoxified by any one of several processes present in human organ-systems (Ames *et al.*, 1987). As a result, humans may not react to the same degree as the population of genetically homogeneous laboratory animal populations used in standard bioassays.

Slope Factors - Cancer slope factors, by definition, are a "plausible upper-bound estimate of the probability" of developing cancer per unit dose over a lifetime. These estimates are conservative for two reasons; (1) they are based on the most conservative model (*i.e.*, linearized multistage model) for extrapolating dose-response information from high doses to low doses, and (2) the 95% UCL of the slope of the dose-response curve is used when the information is based on animal studies. In some cases, slope factors derived from human studies are based on the best estimate (*i.e.*, median) of the dose-response curve (U.S.EPA, 1989).

Route-to-Route Extrapolation - In this risk assessment, oral toxicity values were used to fill toxicity value gaps for dermal exposures. This practice is uncertain due to inherent differences in the absorption, pharmacokinetics, and target organ specificity of chemicals following different routes of exposure. Therefore, any risk estimates calculated using these extrapolated values may also carry significant uncertainty.

5.4.3 Exposure Assessment

Hypothetical Exposures - Potential risks from exposure to Site soils were evaluated for an industrial worker and a construction worker scenario. This risk evaluation is considered to be

hypothetical, however, because it is based on several assumptions that do not reflect the actual present conditions, or expected future conditions, at the site. In particular, the risks and acceptable soil lead concentrations were calculated assuming nearly unlimited direct contact by the industrial worker with the Treated Material for a period of 25 years. As stated previously, most if not all of the Treated Material is presently overlain by 2 ½ feet of a native soil cap that effectively precludes any current direct exposures. Moreover, the site is currently an inactive industrial facility and, therefore, there is no current exposure to the Treated Material and thus, no health risk.

Exposure Parameters - Several parameters were incorporated into the exposure assessment that entails the use of conservative values to define general population behavior. Conservative default values used for exposure parameters (*i.e.*, estimates of 100 mg/day soil ingestion for adult construction workers) were chosen to evaluate RME populations. It was assumed that the individual was exposed to the 95% UCL soil concentration for the entire duration of exposure (25 years) and that all soil contacted during the course of a work day was derived solely from each of the AOCs. It was also assumed that the COCs were present in surface soil which is presently not the case. The COCs are currently located down to 22 feet below the ground surface and, therefore, are not currently available for exposure to on-site industrial workers. The net effect of these conservative exposure assumptions is the overestimation of potential health risks.

Exposure Frequency – It is worthy of closer examination to assess the impact of exposure frequency on the risk estimates. Should the site be redeveloped and if buildings, pavement or structures that preclude direct contact with soil are put in place, then the calculated risks would be dramatically reduced. For example, should the exposure be limited to approximately 4 days per month or 50 days per year, then the calculated risks would be reduced as follows:

Exposure Scenario	Area A	Area B	Area C
Industrial Worker	1×10^{-6}	3×10^{-6}	2×10^{-6}

Exposure frequency may be reduced to 50 days per year or less in a number of ways, including but not limited to the following (or any combination thereof):

- Maintaining a soil or clay cap over the Treated Material;
- Planting grass or other vegetation over the Treated Material;
- Paving over the Treated Material;
- Installing or constructing structures over the Treated Material; or
- The majority of worker activities are indoors or away from the Treated Material.

Should any of the foregoing uses of the Site be implemented, any health risk associated with leaving the Treated Material in place would thereby be greatly reduced or even eliminated.

Even assuming nearly unlimited direct contact with the Treated Material if left in place, the Treated Material would not pose an unacceptable health risk to potential future industrial and construction workers at the Site. Moreover, there are several plausible future uses of the Site (e.g., maintaining a soil or clay cap, planting grass or other vegetation, paving, construction of structures over the Treated Material, or worker activities away from Treated Material) any of which, if implemented, would limit direct contact with the Treated Material to less that that assumed by this HRA thereby greatly reducing or even eliminating any potential health risks.

5.4.4 Risk Characterization

Summation of Hazard Indices Across Pathways - In this assessment, the potential for noncancer health risks was evaluated assuming additivity across exposure pathways and for all COCs. This practice, although conservative, ignores possible synergisms or antagonisms with other chemicals, which may be present in the environment which may affect the absorption, metabolism (metabolic activation or detoxification), and ultimately the net toxicity of the COCs. Therefore, there is a significant amount of conservatism associated with the assumption of additivity used in this assessment.

5.4.5 Uncertainty Analysis Summary

This HRA included many conservative assumptions to ensure that the potential for current and future exposures are not underestimated. These conservatisms effectively combine to yield risk and hazard estimates that likely far exceed any true exposure conditions that currently exist or which could possibly exist in the future. Because of this, the risk and hazard estimates quantified in this HRA likely overestimate the true potential for adverse health effects associated with exposure to the COCs at the site.

6.0 SUMMARY

This HRA evaluated the potential carcinogenic and noncarcinogenic health risks associated with the placement of Treated Material on the Site. The Site was assessed as three separate areas, Areas A, B and C. Based on the SAR (HET, 2004) and RECAP screening process, the chemicals and medium of concern were determined to be arsenic and lead Site soil (which includes the Treated Material and surrounding soils). Specifically, arsenic in Area A and arsenic and lead in Areas B and C were determined to be COCs in soil and were quantitatively addressed in the HRA.

Use of the site is expected to be industrial, thus, potential risks from exposure to Site soils were evaluated for an industrial worker and a construction worker scenario (as potential exists for earth moving activities). The total noncarcinogenic hazard indices for both the construction worker and the industrial worker scenarios in each of the three areas were far less than 1, indicating a lack of noncarcinogenic hazard to these potential future workers. The theoretical increased cancer risk for the industrial worker who works in Area A is 5×10^{-6} and 1×10^{-5} for Areas B and C, and for the construction worker, the theoretical increased cancer risk was 3×10^{-6} in Area A, and 6×10^{-6} in Areas B and C. Since these risks are within the levels considered acceptable by the U.S.EPA for Superfund sites (10^{-4} to 10^{-6}) (U.S.EPA, 1990) and the LDEQ requirements (LDEQ, 2003), they should be considered acceptable for this site.

The U.S. EPA Adult Lead Model was used to derive acceptable soil concentrations of lead for Areas B and C, the only two Treated Material areas that contained lead above the RECAP standard. Acceptable soil lead concentrations were developed using two target blood lead levels, 10 µg/dL and 30 µg/dL. As stated, the former is intended to be protective of the fetus of pregnant women and is a U.S.EPA guideline (U.S. EPA 1996b) while the latter is the OSHA limit for the general worker population (OSHA 29 CFR 1910.1025) and is protective of women of child bearing age. The results of this analysis are presented in the table below:

Exposure Scenario	10 µg/dL Target Blood Lead	30 µg/dL Target Blood Lead
Industrial Worker Scenario	1,980	9,490 mg/kg
Construction Worker Scenario	990	4,750 mg/kg

The 95 percentile upper confidence limit on the arithmetic mean (95% UCL) of lead in Area B is 3,715 and 2,223 in Area C. Thus, the lead concentrations present in Areas B and C are not expected to present an unacceptable health risk to future industrial and commercial workers at the Site as they fall within the range of safe soil concentrations as determined by this HRA using the U.S.EPA Adult Lead Model.

It should also be noted that the risks and acceptable soil lead concentrations were calculated assuming nearly unlimited direct contact for several years, 25 years in fact. As the site is currently an inactive industrial facility and most if not all of the Treated Material is capped with approximately 2 1/2 feet of native soil, there is no current exposure and thus, no health risk. If one or more plausible future uses of the site are implemented (e.g. maintaining a soil or clay cap, planting grass or other vegetation, paving, construction of structures over the Treated Material, or conducting the majority of worker activities indoors or away from the Treated Material), direct contact to the Treated Material would be limited to 50 days per year. The Uncertainty Analysis of this HRA quantitatively determined that the potential risk would be reduced to near *de minimis* levels (i.e., 1×10^{-6} for Area A; 3×10^{-6} for Area B; 2×10^{-6} for Area C) should direct contact be limited to 50 days per year or less.

In conclusion, as Site media pose neither a significant noncarcinogenic nor carcinogenic risk to potential future use scenarios, it should not be necessary to calculate cleanup standards using any of the RECAP Management Options.

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Table 1. Area A Treated Material Samples

Constituent	Concentration Units	95% UCL	MO-1	Retained as a COC?
Antimony	mg/kg	49	820	No; does not exceed MO-1
Arsenic	mg/kg	28	12	Yes; exceeds MO-1
Barium[a]	mg/kg	6,622	70,000	No; does not exceed MO-1
Cadmium[a]	mg/kg	15	500	No; does not exceed MO-1
Chromium (total)	mg/kg	105	1,000,000	No; does not exceed MO-1
Lead	mg/kg	603	1,400	No; does not exceed MO-1

a MO-1 values have been adjusted for additive noncarcinogenic effects, as appropriate. Specifically, the target endpoint for both barium and cadmium is the kidney, thus their MO-1 values have been adjusted by a factor of 2; it was not necessary to adjust any other metals.

Table 2. Area B Treated Material Samples

Constituent	Concentration Units	95%UCL	MO-1	Retained as a COC?
Antimony	mg/kg	191	820	No; does not exceed MO-1
Arsenic	mg/kg	63	12	Yes; exceeds MO-1
Barium[a]	mg/kg	5,784	70,000	No; does not exceed MO-1
Cadmium[a]	mg/kg	143	500	No; does not exceed MO-1
Chromium (total)	mg/kg	755	1,000,000	No; does not exceed MO-1
Copper	mg/kg	6,482	82,000	No; does not exceed MO-1
Iron	mg/kg	42,311	321,000[b]	No; does not exceed MO-1
Lead	mg/kg	3,715	1,400	Yes; exceeds MO-1

a MO-1 values have been adjusted for additive noncarcinogenic effects, as appropriate. Specifically, the target endpoint for both barium and cadmium is the kidney, thus their MO-1 values have been adjusted by a factor of 2; it was not necessary to adjust any other metals.

b Calculated using LDEQ screening equation and default exposure parameters for an industrial scenario.

Table 3. Area C Treated Material Samples

Constituent	Concentration Units	95% UCL	MO-1	Retained as a COC?
Antimony	mg/kg	215	820	No; does not exceed MO-1
Arsenic	mg/kg	60	12	Yes; exceeds MO-1
Barium[a]	mg/kg	6,405	70,000	No; does not exceed MO-1
Cadmium[a]	mg/kg	36	500	No; does not exceed MO-1
Chromium (total)	mg/kg	762	1,000,000	No; does not exceed MO-1
Copper	mg/kg	1,753	82,000	No; does not exceed MO-1
Iron	mg/kg	42,222	321,000[b]	No; does not exceed MO-1
Lead	mg/kg	2,223	1,400	Yes; exceeds MO-1

a MO-1 values have been adjusted for additive noncarcinogenic effects, as appropriate. Specifically, the target endpoint for both barium and cadmium is the kidney, thus their MO-1 values have been adjusted by a factor of 2; it was not necessary to adjust any other metals.

b Calculated using LDEQ screening equation and default exposure parameters for an industrial scenario.

Table 4. Agency Verified Reference Doses and Slope Factors

Parameter	CAS#	Oral Reference Dose	Source	Inhalation Reference Dose	Source	Oral Slope Factor	Source	Inhalation Slope Factor	Source	Dermal Absorption Factor	Source
Arsenic	7440360	3.0E-04	U.S. EPA 2004	0.0003	U.S. EPA 2004	1.5	U.S. EPA 2004	15	U.S. EPA 2004	0.03	LDEQ, 2003
Lead	7439921	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

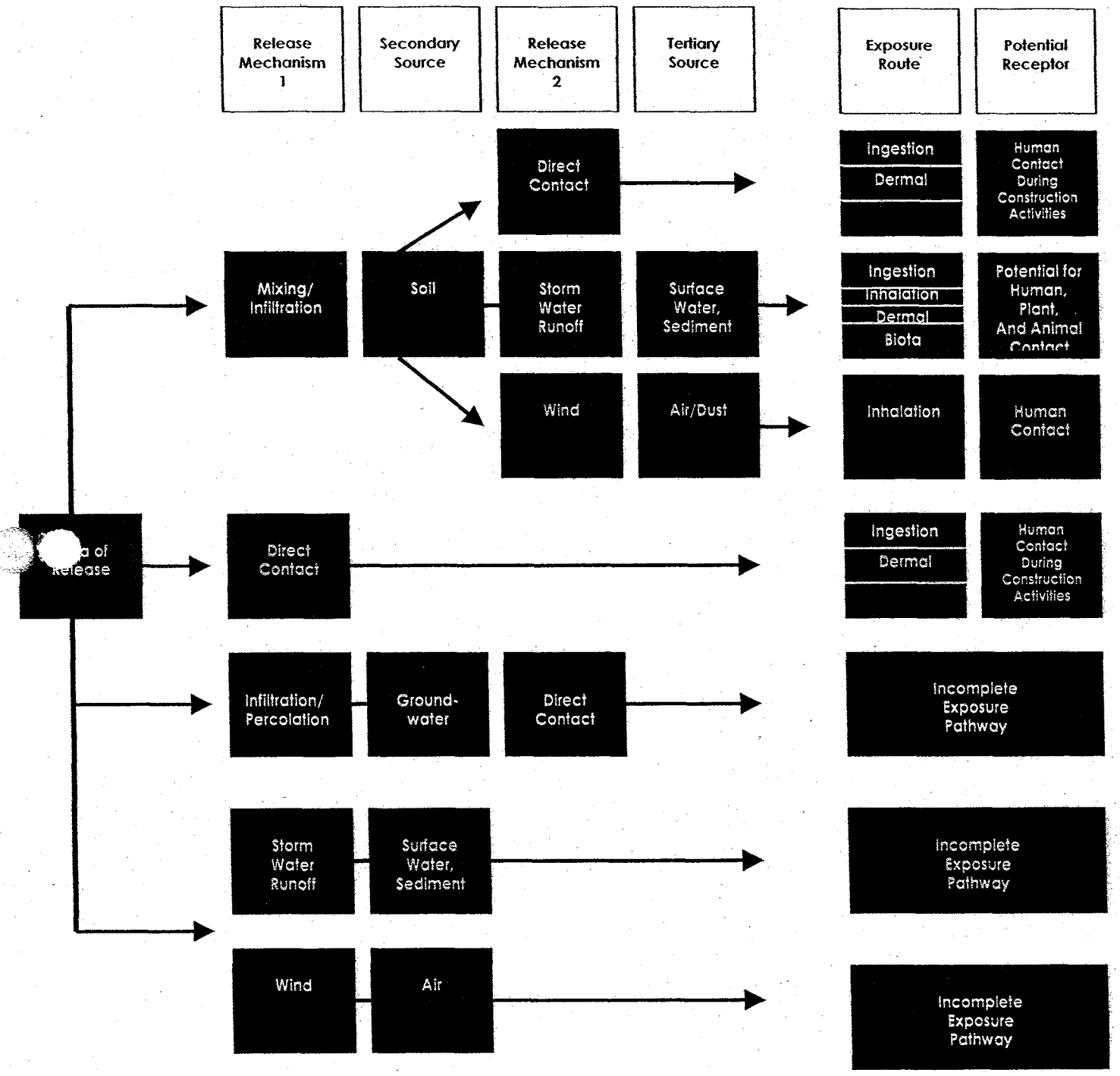
Table 5. Exposure Parameters

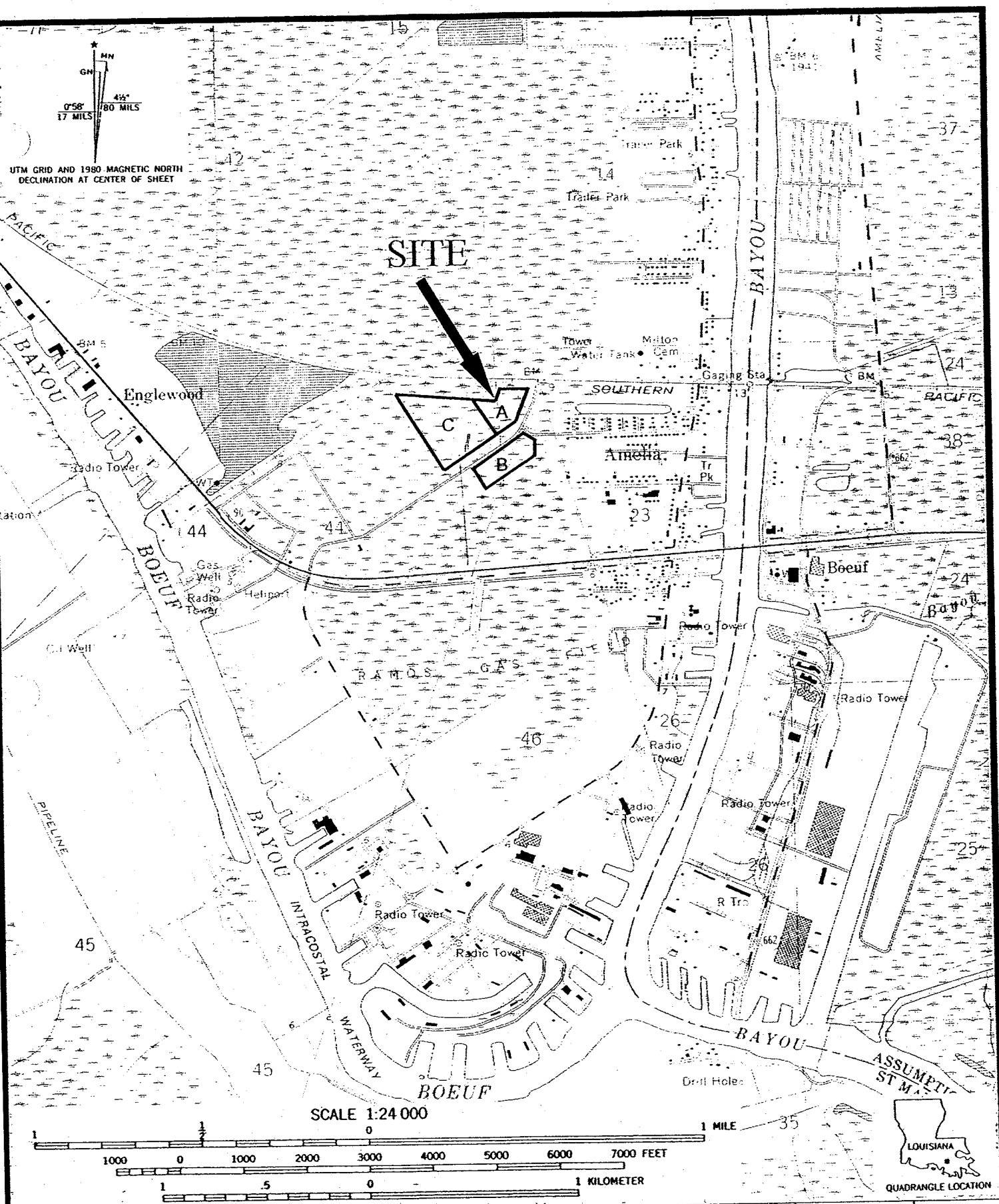
	Parameter	Industrial Worker Scenario	Source	Construction Worker Scenario	Source
BW	Body Weight (kg)	70	LDEQ, 2003	70	LDEQ, 2003
AT	Averaging Time				
	Noncarcinogens	25	LDEQ, 2003	1	Professional Judgement
	Carcinogens	70	LDEQ, 2003	70	LDEQ, 2003
EF	Exposure Frequency (days/year)	250	LDEQ, 2003	250	LDEQ, 2003
ED	Exposure Duration (years)	25	LDEQ, 2003	1	Professional Judgement
SIR	Soil Ingestion Rate (mg/day)	50	LDEQ, 2003	100	U.S. EPA 1997
IR	Inhalation Rate (m^3/day)	20	LDEQ, 2003	20	LDEQ, 2003
SA	Skin Surface Area (cm^2)	3,300	LDEQ, 2003	3,300	LDEQ, 2003
PEF	Particulate Emission Factor (mg/cm^2)	6.72×10^8	U.S.EPA 2002b	4.44×10^5	U.S. EPA 1995
AF	Soil-to-Skin Adherence Factor (mg/cm^2)	0.2	LDEQ, 2003	0.2	LDEQ, 2003
DAF	Dermal Absorption Factor (unitless)				
	Arsenic	0.03	LDEQ, 2003	0.03	LDEQ, 2003
OBF	Oral Bioavailability Factor (unitless)				
	Arsenic	0.5	Scientific Literature	0.5	Scientific Literature
MET	Meteorological Factor (unitless)	0.68	Section 4.6	0.68	Section 4.6

Table 6. Hazard Indices and Theoretical Increased Cancer Risk

Scenario	Area A		Area B		Area C	
	Hazard Index	Risk	Hazard Index	Risk	Hazard Index	Risk
Industrial Worker	0.06	5×10^{-6}	0.1	1×10^{-5}	0.1	1×10^{-5}
Construction Worker	0.2	3×10^{-6}	0.3	6×10^{-6}	0.3	6×10^{-6}

Conceptual Site Model





USGS Drawn By	SLS Approved By	1113.02 Project #	05/25/04 Date

Figure 1. Site Location Map of the Recycling Park, Inc. facility located on Lake Palourde Bypass in Amelia, St. Mary Parish, Louisiana. Source: USGS 7.5 Minute Series, Morgan City and Amelia, Louisiana Quadrangles.

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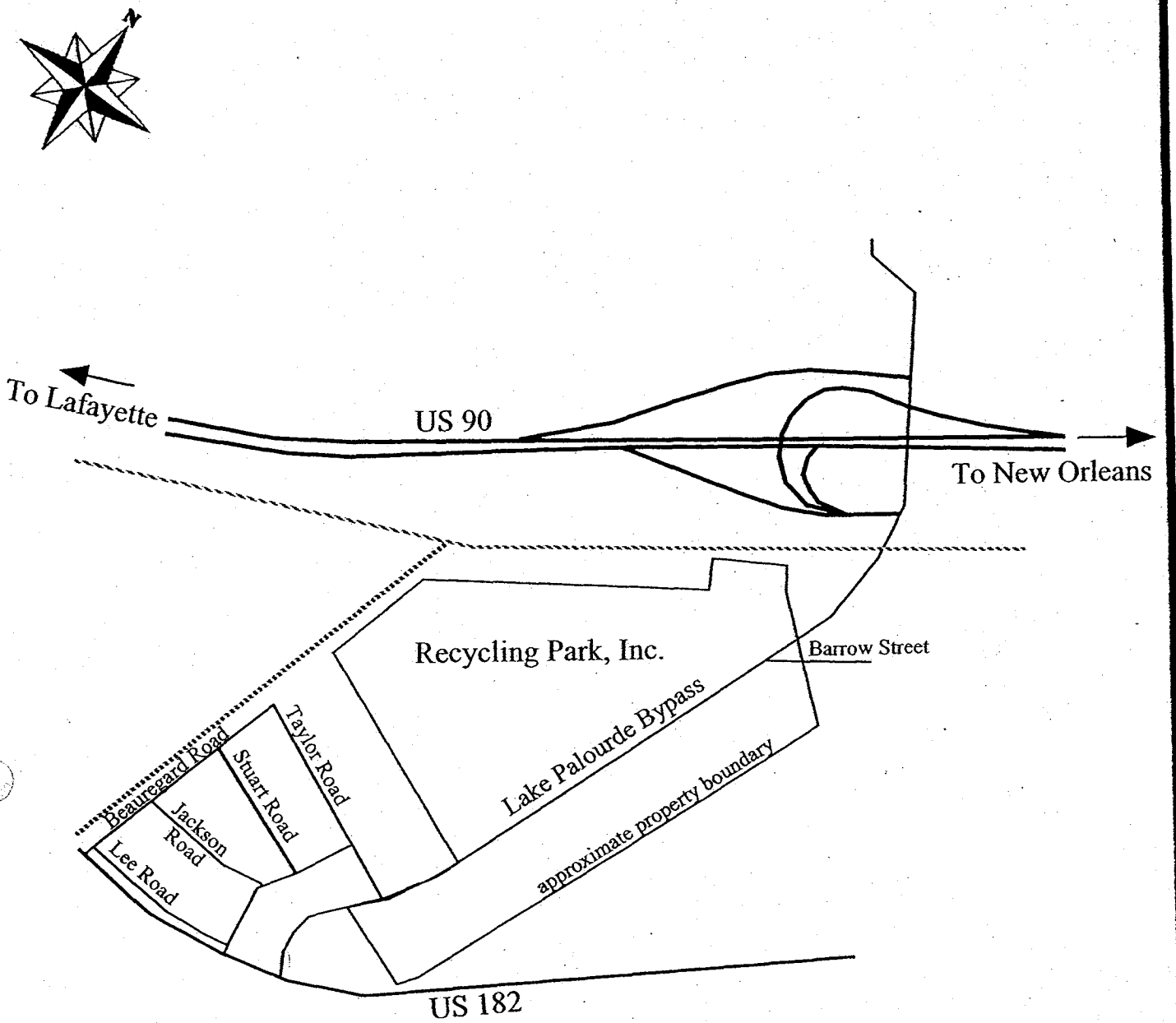

0 1000 2000

Scale in Feet

BTP Drawn By	SLS Approved By	1113.02 Project #	05/25/04 Date

Figure 2. Regional Map of the Recycling Park, Inc. property located on Lake Palourde Bypass in Amelia, St. Mary Parish, Louisiana.

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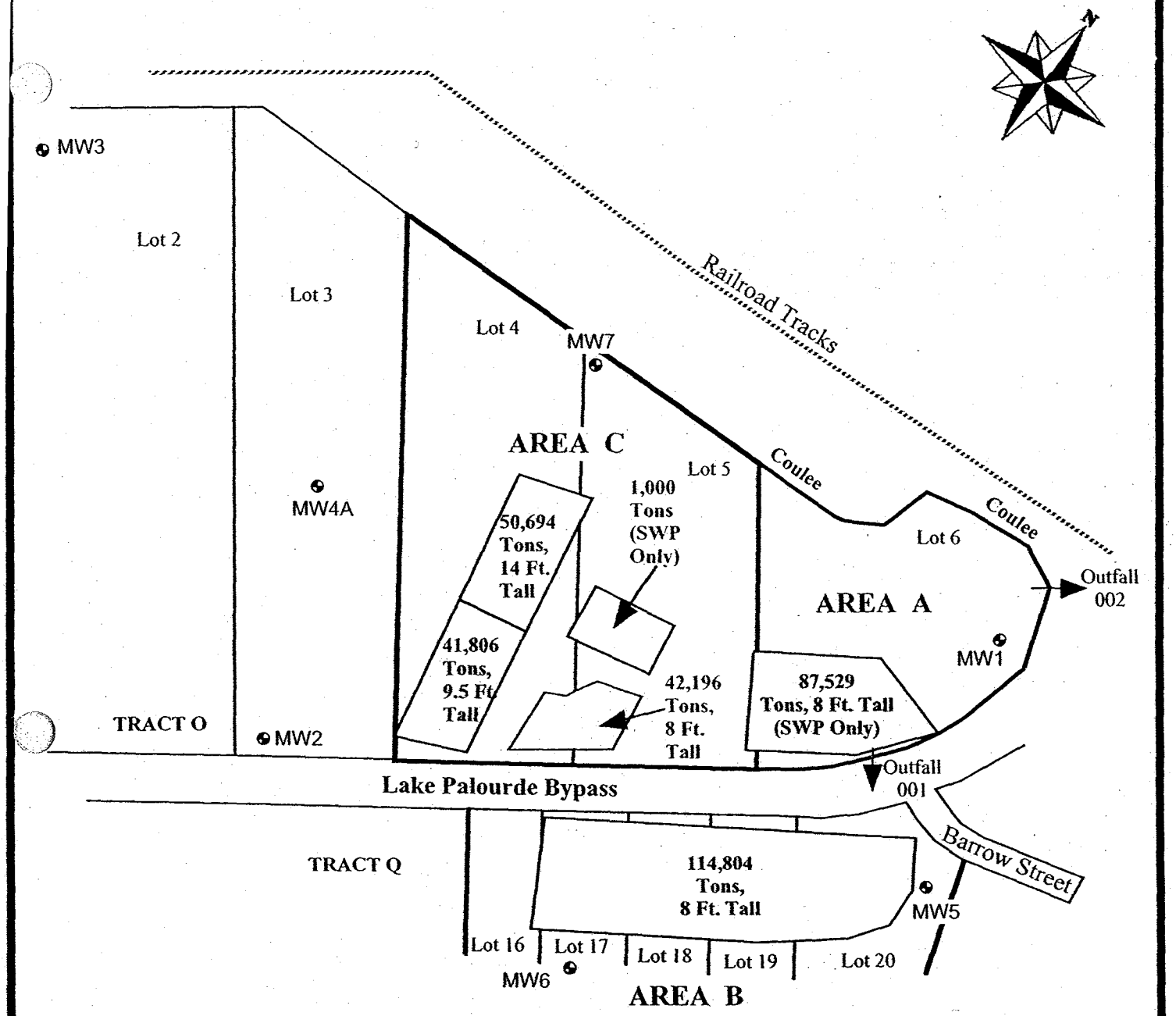

EXPLANATION

- EXISTING MONITOR WELL LOCATION
- AGGREGATE PILE
- SWP SOUTHERN WOOD PIEDMONT
- STORMWATER OUTFALL LOCATION

0 350 700

Scale in Feet

BTP Drawn By	SLS Approved By	1113.02 Project #	05/25/04 Date

re 3. Generalized Site Plan Map of the Recycling Park, Inc.
vision 01. facility located on Lake Palourde Bypass in Amelia, St. Mary Parish, Louisiana.

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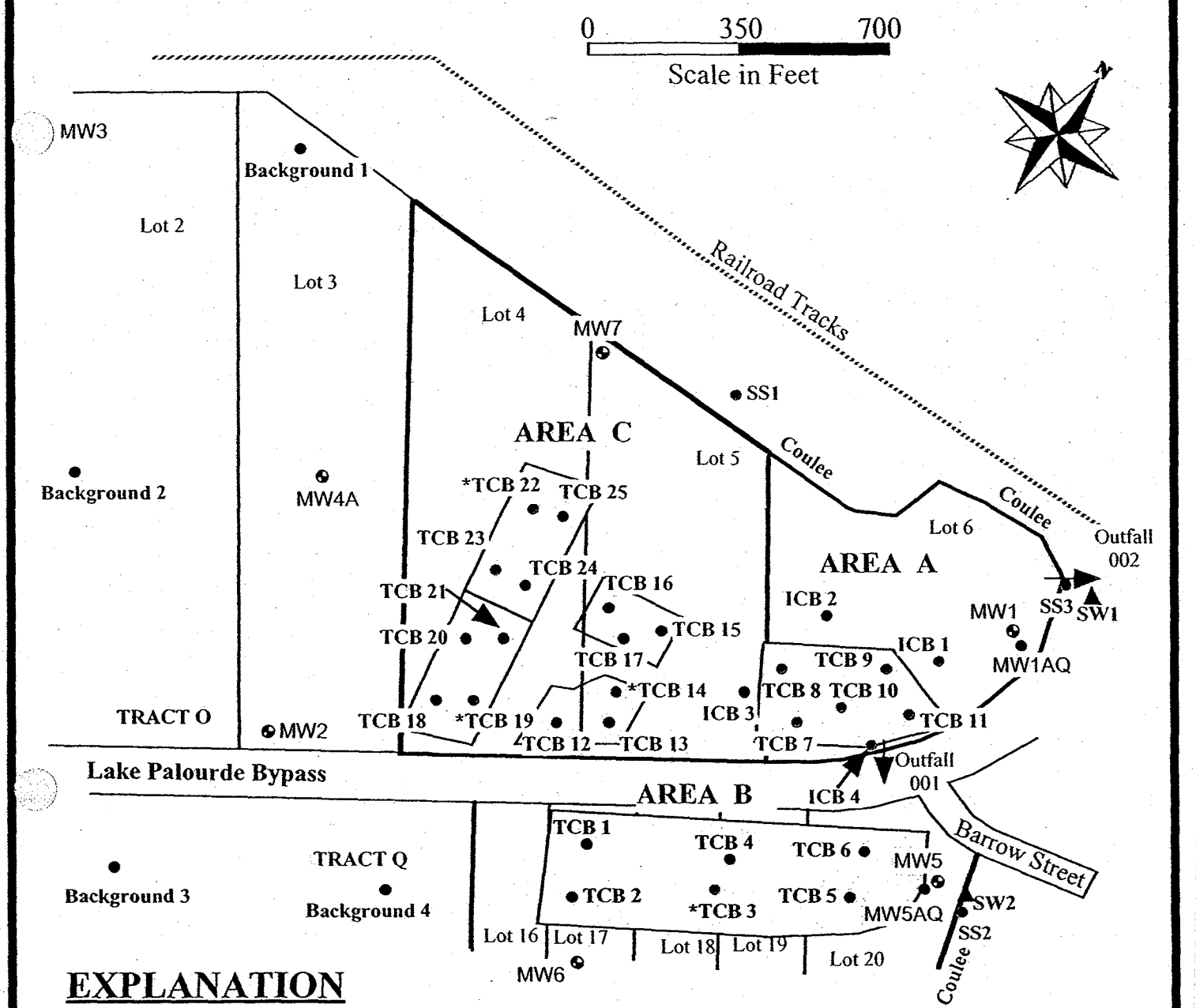

EXPLANATION

- EXISTING MONITOR WELL LOCATION
- AGGREGATE PILE
- SWP SOUTHERN WOOD PIEDMONT
- STORMWATER OUTFALL LOCATION
- BORING LOCATION (TAL ONLY)
- BORING LOCATION (TAL/TCL)
- AQUIFER TEST BORING LOCATION
- SURFACE WATER (SW) SAMPLING LOCATION (TAL/TCL)
- SS INDICATES SEDIMENT SAMPLING BORING
- ICB INDICATES IMPACT CHARACTERIZATION BORING
- TCB INDICATES TREATED MATERIAL CHARACTERIZATION BORING
- BORING LOCATION (TCLP only)

*Note: Borings TCB3, TCB 14, TCB 19, and TCB 22 were installed to allow for sampling of native soils beneath the Treated Material Pile.

BTP Drawn By	SLS Approved By	1113.02 Project #	05/25/04 Date

...re 4. Generalized Site Plan Map of the Recycling Park, Inc. facility ...evision 03. located on Lake Palourde Bypass in Amelia, St. Mary Parish, Louisiana illustrating the location of the boring, sediment, groundwater, aquifer test, and surface water sampling locations.

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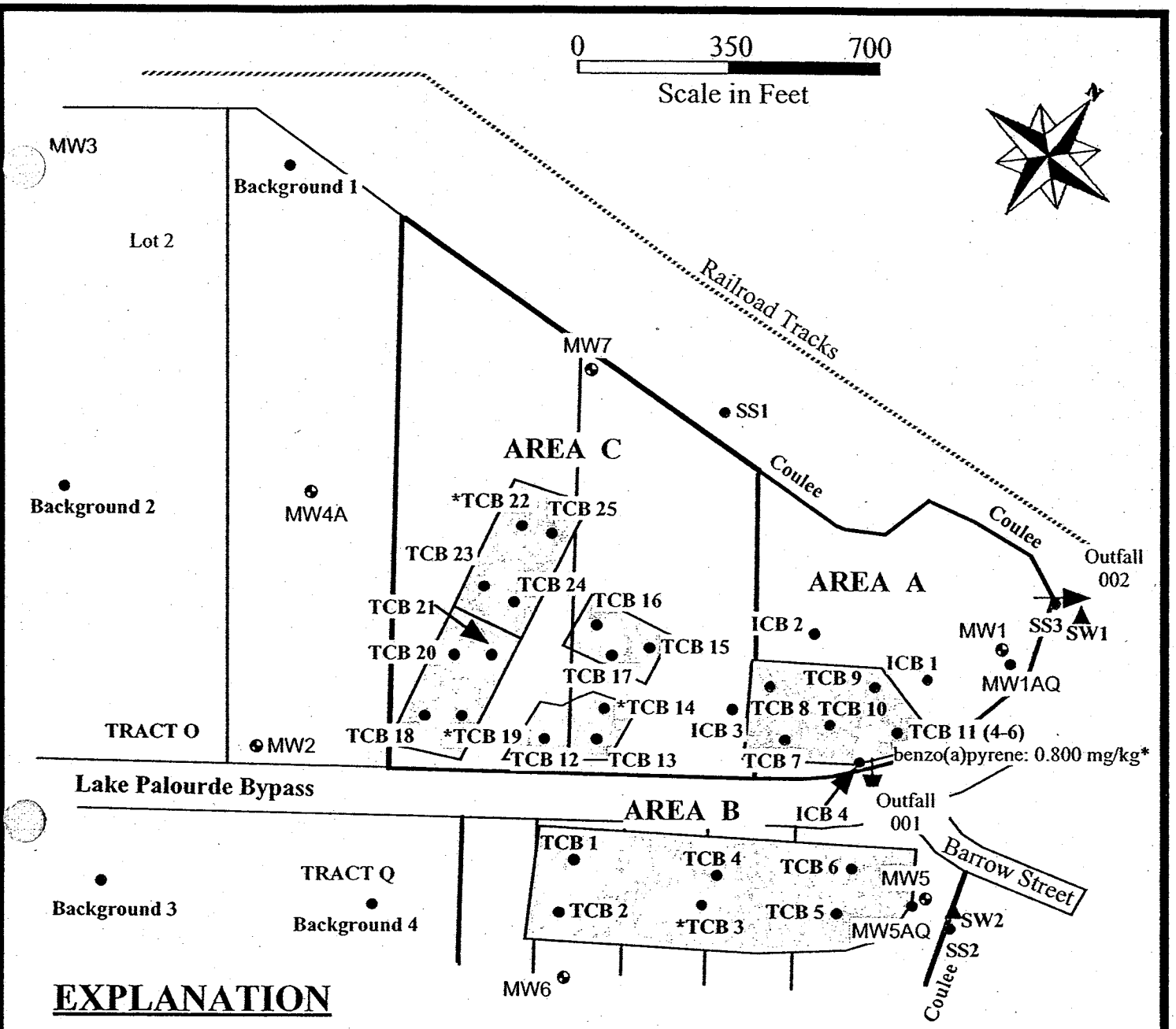

EXPLANATION

- EXISTING MONITOR WELL LOCATION
- AGGREGATE PILE
- SWP SOUTHERN WOOD PIEDMONT
- STORMWATER OUTFALL LOCATION
- BORING LOCATION (TAL ONLY)
- BORING LOCATION (TAL/TCL)
- AQUIFER TEST BORING LOCATION
- ▲ SURFACE WATER (SW) SAMPLING LOCATION (TAL/TCL)
- SS INDICATES SEDIMENT SAMPLING BORING
- ICB INDICATES IMPACT CHARACTERIZATION BORING
- TCB INDICATES TREATED MATERIAL CHARACTERIZATION BORING
- BORING LOCATION (TCLP only)

*RECAP SS: benzo(a)pyrene: 0.330 mg/kg

*Note: Borings TCB3, TCB 14, TCB 19, and TCB 22 were installed to allow for sampling of native soils beneath the Treated Material Pile.

BTP	SLS	1113.02	05/25/04
Drawn By	Approved By	Project #	Date

re 12. TCL Organic Treated Material and Soil Concentration Map for those constituents with concentrations above the appropriate RECAP screening standards. Concentrations reported in milligrams per killigram (mg/kg).
Note, only soil sample TCB11(4-6) contained concentrations of TCL above RECAP screening standards.

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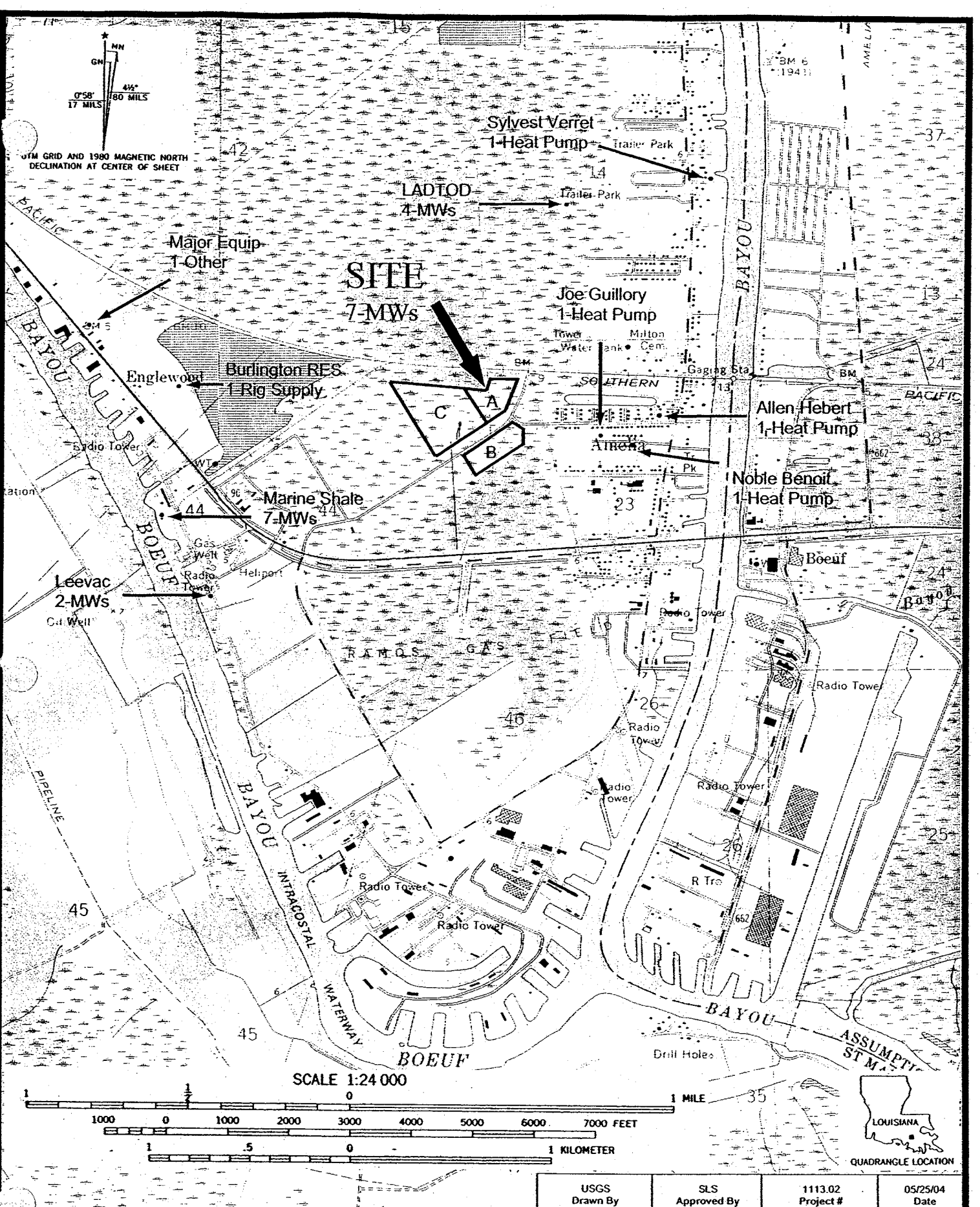

USGS	SLS	1113.02	05/25/04
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Figure 14. One (1) Mile Sensitive Receptor Map.

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APPENDIX E

FORM OF CONVEYANCE NOTIFICATION

"CONVEYANCE NOTIFICATION

Recycling Park, Inc., [insert address], hereby notifies the public that a human health risk assessment (the "Risk Assessment") has been performed on the following described Area of Investigation (the "Site"), Louisiana Department of Environmental Quality (LDEQ) Agency Interest Number (AI No. _____), and that the Site is the subject of a Consent Decree (the "Consent Decree") entered on _____, 200__, by the United States District Court, Western District of Louisiana, Lafayette Division, in the matter captioned "United States of America v. Marine Shale Processors, Inc., et al", Civil Action No. CV90-1240 (Judge Adrian G. Duplantier, United States District Court, Eastern District of Louisiana, presiding), which provides for corrective action (the "Remedial Measures") to be performed at the Site, including placement of a cap over contaminants (referred to in the Consent Decree as "Disputed Material") (the "Disputed Material") at the Site.

Site Description:

The Site is identified as being the Recycling Park, Inc. property located [insert address]. A legal description of the Site is as follows:

[insert legal property description]

Recycling Park, Inc. hereby further notifies the public that Disputed Material will remain at the Site after completion of the Remedial Measures with contaminant levels that are acceptable for industrial/commercial use of the property as described in the Louisiana Department of Environmental Quality's ("LDEQ") Risk Evaluation/Corrective Action Program (RECAP) dated October 20, 2003, Section 2.9, and that:

1. The Site shall not be used for any use other than an industrial/commercial land use as described in RECAP, Section 2.9.

2. The cap material at the Site shall not be disturbed or removed.

3. If any cap material at the Site is disturbed or removed in violation of provision 2 above, the person or entity who disturbs or removes the cap material shall immediately repair and restore same.

4. No Disputed Material shall be removed from the Site except with the prior written consent of the United States Environmental Protection Agency ("EPA") and LDEQ, or their respective successor agencies or departments.

5. If any Disputed Material is removed from the Site:

a. The Disputed Material shall be managed and transported as solid waste and shall be disposed of in a permitted Type I Industrial Solid Waste landfill under Louisiana Administrative Code Title 33, Part VII, or in an equivalent RCRA Subtitle D landfill if disposed of outside of Louisiana, in a separate and segregated cell containing no material other than the Disputed Material, unless the total volume of the Disputed Material removed from the Site is less than 100 tons, in which case a separate and segregated cell shall not be required; and

b. The person or entity removing the Disputed Material from the Site shall be designated as the sole "generator" of any such Disputed Material removed from the Site on any manifests, records, or other documents related to such removal.

6. No persons or entities shall interfere with any remedial or corrective actions approved by EPA and LDEQ and implemented at the RPI Facility.

No person shall allow, cause, or attempt to cause this Conveyance Notification to be modified in any manner or canceled from the official conveyance records of the Clerk of Court of St. Mary Parish, Louisiana, except with the prior written consent of EPA and LDEQ, or their respective successor agencies or departments.

Information regarding this site is available in the LDEQ public record and may be obtained by contacting the LDEQ Records Manager for LDEQ at (225) 219-3168. Inquiries regarding the contents of this site may be directed to:

[insert name and address]

A summary of soil and Disputed Material analytical data is provided on the attached Table 1, and is graphically depicted on the attached Figure 1.

A summary of groundwater analytical data is provided on the attached Table 2, and is graphically depicted on the attached Figure 2.

_____

John M. Kent, President
Recycling Park, Inc.

(Signature of Person Filing Parish Records)

_____

Date

(A true copy of the document certified by the parish clerk of court must be sent to the Remediation Services Division, Post Office Box 4314, Baton Rouge, Louisiana 70821-4314.)"

APPENDIX F

Form of Transfer Provision[1]

"**Agreements by [Transferee].**

a. [Transferee]: (1) acknowledges and agrees that the property described herein is subject to all provisions, restrictions, and requirements set forth in that certain Conveyance Notification recorded in the official conveyance records of the Clerk of Court of St. Mary Parish, Louisiana, under File No. _____ (the "Conveyance Notification"); (2) [Transferee] shall fully comply with all provisions, restrictions, and requirements set forth in the Conveyance Notification; (3) [Transferee] shall not allow any person that is present on the Property with the permission of [Transferee], its tenants, contractors, agents, or invitees, or subject to the control of [Transferee], to violate any provisions, restrictions, and requirements set forth in the Conveyance Notification; and (4) [Transferee] shall not allow, cause, or attempt to cause the Conveyance Notification to be modified in any manner or canceled from the official conveyance records of the Clerk of Court of St. Mary Parish, Louisiana, except with the prior written consent of the United States Environmental Protection Agency ("EPA") and the Louisiana Department of Environmental Quality ("LDEQ"), or their respective successor agencies or departments.

b. It is the intent and agreement [Transferee] to ensure that every future owner or transferee of any interest or rights in all or any part of the property described herein ("Transferee") shall fully comply with all provisions, restrictions, and requirements set forth in the Conveyance Notification, and that the subject property shall remain subject to all provisions, restrictions, and requirements set forth in the Conveyance Notification, unless and until the Conveyance Notification is modified or canceled by, or with the prior written consent of, EPA and LDEQ, or their respective successor agencies or departments. Accordingly, [Transferee] agrees that it shall not sell, exchange, donate, grant a servitude in, or otherwise convey, transfer, or grant of any interest or rights in all or any part of the subject property unless [Transferee] includes sections identical to this section entitled "Agreements by [Transferee]" and the following section entitled "Third Party Beneficiaries; Violation; Injunctive Relief" in any future sale, exchange, donation, lease, servitude, or other conveyance, transfer, or grant of any interest or rights in all or any part of the subject property.

Third Party Beneficiaries; Violation; Injunctive Relief.

a. The agreements set forth in the section above entitled "Agreements by [Transferee]" shall be binding upon Transferee and [its/his/her/their] heirs, successors, and assigns. Further, [Transferee] hereby expressly declares and agrees that the agreements set forth in the section above entitled "Agreements by [Transferee]" are intended to and shall confer upon EPA and LDEQ, and their respective successor

[1] The name or designation of the transferee shall be inserted in place of the term "[Transferee]".

agencies or departments, legal or equitable rights, benefits, or remedies as set forth herein, and that EPA and LDEQ, and their respective successor agencies or departments, are third party beneficiaries of and may enforce the said agreements and exercise the remedies, including but not limited to injunctive relief, set forth herein.

b. In the event of any violation or threatened violation by [Transferee] of any of the agreements set forth in the section above entitled "Agreements by [Transferee]" and the provisions and requirements of the Conveyance Notification, EPA and LDEQ, and their respective successor agencies or departments, will have, in addition to all other remedies that may be available to them under applicable law, the right to enforce the agreements set forth in the section above entitled "Agreements by [Transferee]" and the provisions and requirements of the Conveyance Notification by specific performance, and the right to enjoin such violation or threatened violation, in a court of competent jurisdiction by injunctive relief. [Transferee] agrees and stipulates that [its/his/her/their] obligations set forth in paragraphs a.(3) and (4) and b of the section above entitled "Agreements by [Transferee]" are "obligations not to do" and that EPA and LDEQ, and their respective successor agencies or departments, may enjoin violations or threatened violations of such obligations without proof of irreparable injury."